NOVEMBER, 1928

# Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1926, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879.

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# Railway Engineering and Maintenance

*Formerly the Railway Maintenance Engineer*

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Published on the last Thursday preceding the month of issue by the

**Simmons-Boardman Publishing Company, 105 West Adams Street, Chicago, Ill.**

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**SAN FRANCISCO: 215 Market Street**

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

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Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents.

*Railway Engineering and Maintenance is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.)*

# *Building out shoulders for 7¢ per yard*

FROM 15 to 75c per cubic yard has been considered a fair price for building out shoulders on the Union Pacific until a Northwest dragline working from the ditch tackled the job near Frankfort, Kansas, and built out shoulder along 1350 feet of track per day.

Making all allowances for rental, operating cost, lost time, etc., the Northwest did the job for less than 10c per cubic yard and handled 100 yards of material per hour without difficulty.

Another reason why Northwest Machines with superior mobility and all-around usefulness are cutting costs on railway maintenance work.

Let us tell you more about their successful use by leading railroads.

**NORTHWEST ENGINEERING COMPANY**

*The world's largest exclusive builders of gasoline and electric powered shovels, cranes and draglines*

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**NORTHWEST**

CRANES · SHOVELS **CONVERTIBLE** *and* DRAGLINES

***Gasoline and Electric***

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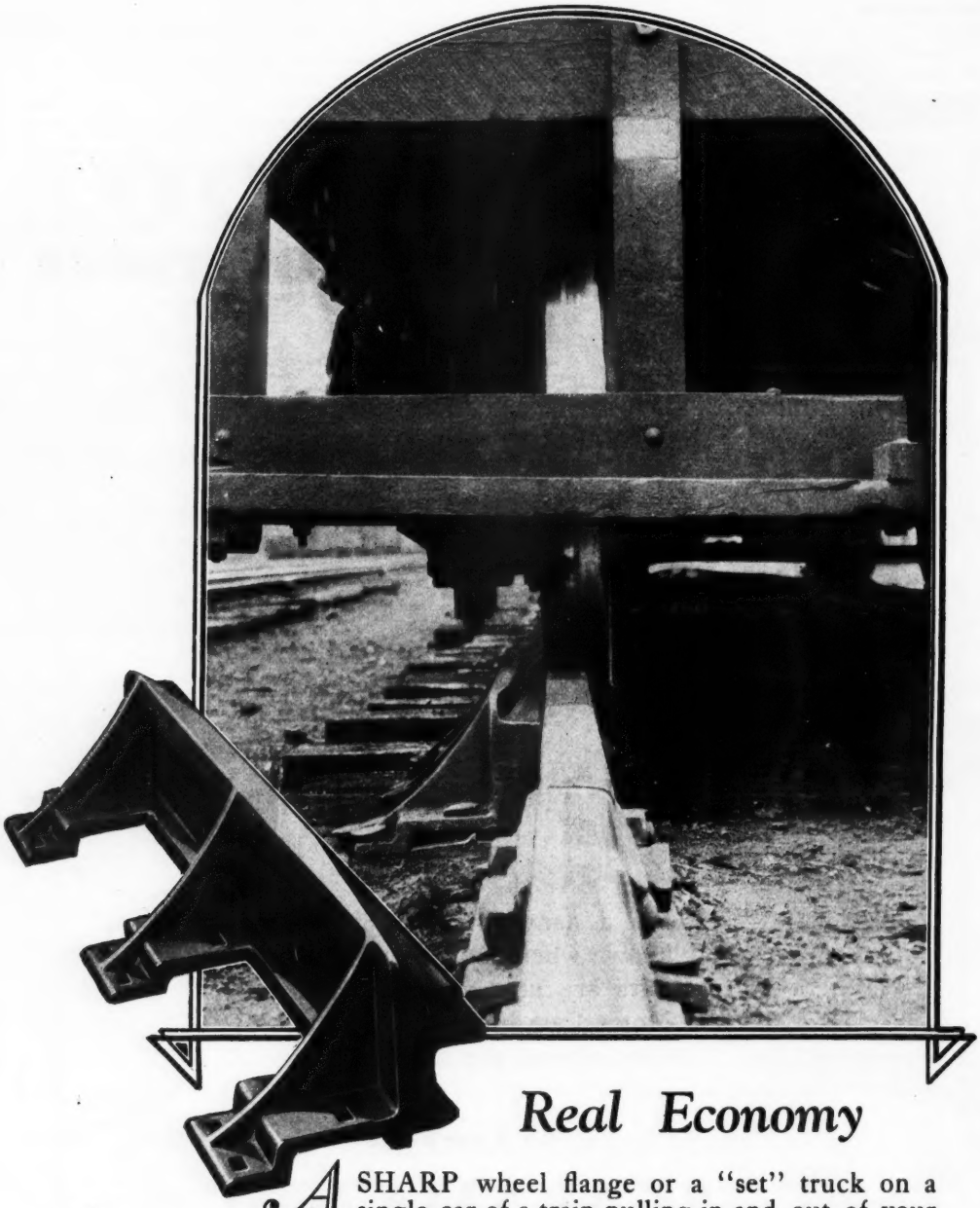


# *Real Economy*

A SHARP wheel flange or a "set" truck on a single car of a train pulling in and out of your yards may pick a loose point and derail, tying up your whole yard and incurring enormous expenses. The Q & C Switch Point Guard will positively eliminate this trouble.

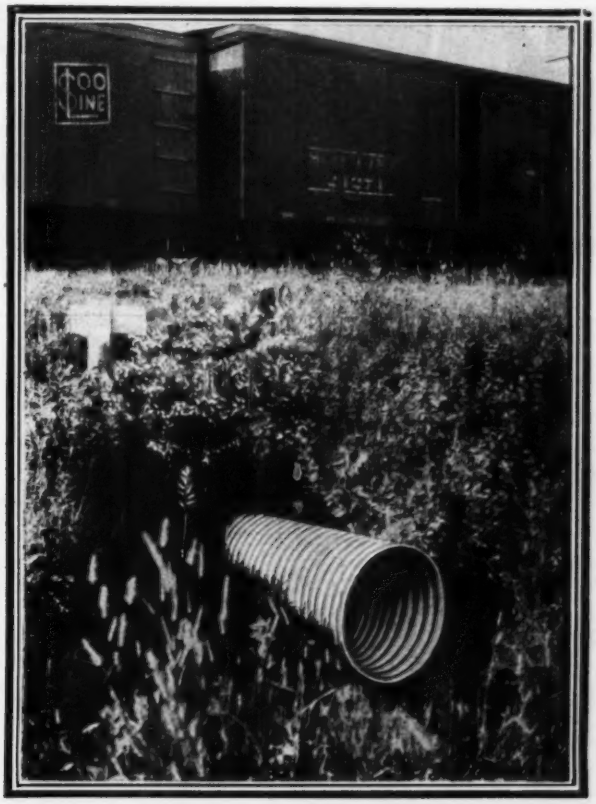
This Q & C Switch Point Guard is a simple one piece manganese casting which is applied on the outside of the running rail, assuring safety. It will increase the life of your switch point many times as it protects the point in either a facing or trailing movement.

Such a device assures real economy and efficiency. Specify the Q & C Switch Point Guard on your requisitions.

*The Q & C Switch Point Guard is recommended for use in yards, side tracks, gravity humps and turn tables.*

**The Q & C Company, 90 West St., N. Y.**

CHICAGO ST. LOUIS




Armco Culvert installed in 1912 in North Dakota under 4 foot fill.

# Why risk an *unproved* drainage structure?

## *Lasting drainage is too essential*

TO use unproved drainage structures is to risk failure. This risk is unnecessary, for there is a twenty-two year service record on which to base your decision. This twenty-two year period of service has proved conclusively:

1. That culverts of flexible design withstand the loads of the deepest fill and heaviest traffic.
2. That culverts of Armco Ingot Iron (99.84% pure without reservation) endures under conditions of culvert service.

These statements can be made only for culverts made of Armco Ingot Iron.

Armco engineers will be glad to help you in planning to assure that *lasting* drainage. This service is yours for the asking.

ARMCO

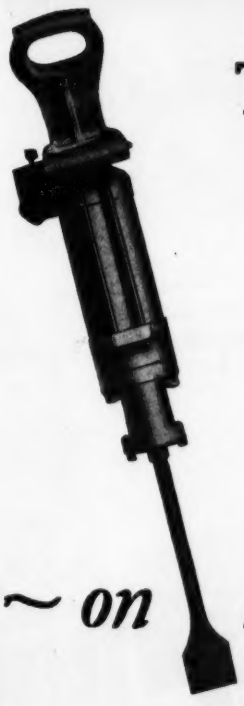
ARMCO CULVERT MANUFACTURERS ASSN.
MIDDLETOWN, OHIO

# ARMCO CULVERTS

*Look under your roads*

# Jack Frost never stopped a SYNTRON!

*It's on the job in every sort of weather, doing a better job of tamping*



THE SYNTRON Electric Tie Tamping Outfit asks no favors. It does not wait for warm weather. When surfacing conditions are right for tamping, you will find the SYNTRON on the job, delivering its power uniformly for a better tamping job. There's nothing to freeze up about a SYNTRON. And that's only one of its many features.

Other features include its ease of handling, the extreme portability of the power unit, equipped with dolly wheels for riding on the track. The SYNTRON Power Unit rests on the track shoulder, operates a large number of electric tools, has fewer parts than any other outfit and costs less to operate.

Keep on tamping ballast until the roadbed is frozen—without loss of time and at little expense. Get a SYNTRON Tie Tamping Outfit and laugh at Old Jack Frost.

**SYNTRON CO., Pittsburgh, Pa.**

*Write for literature illustrating and describing the new 1929 SYNTRON Tamping Outfits with the 20 new features*

*~ on more roadbeds every year*

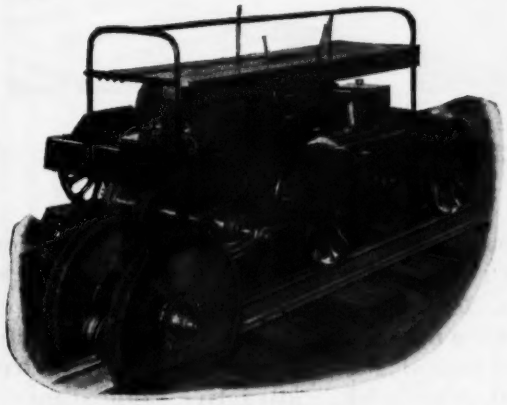
# SYNTRON

## Electric Tie-Tamping Outfits

*SAM, the Section Boss, Says—*

# "Here's ONE Way to Spend Your Money—and Have It, Too!"

"You can't spend your money, and have it too—unless you spend it for something that pays you your money back. There ain't many such things."



## Woolery Tie-Scorer

Using the old rail as a gauge-line, the Woolery Tie-Scorer saws each tie on both sides of the rail—all exactly the same depth below the rail surface. After the old rail is removed, it is much easier for adzman to chip out a flat surface to correct depth, for each tie-plate—instead of the usual "dished" notch.

When the new rail is laid, it finds as level a bearing surface as the old rail had. No more tamping is necessary than the old track needed.

Railroad executives say this Woolery Tie-Scorer is one of the biggest little money-savers ever offered the railroads. Write for complete facts at once.

## Woolery

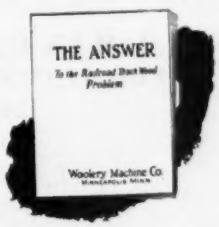
## CONTROL-TYPE Weed Burner

**Destroys Weeds for $3.00 to $6.00 Per Mile**

Our data book gives actual railroad reports of weed destruction showing total costs of $3.00 to $6.00 per mile.

If you have a weed problem, put the new Woolery Weed Burner in **your** budget—it soon pays the money back in actual cash savings—and then goes on paying you a profit besides.

Sounds too good to be true? Make us prove it—ask for this Woolery Data Book.



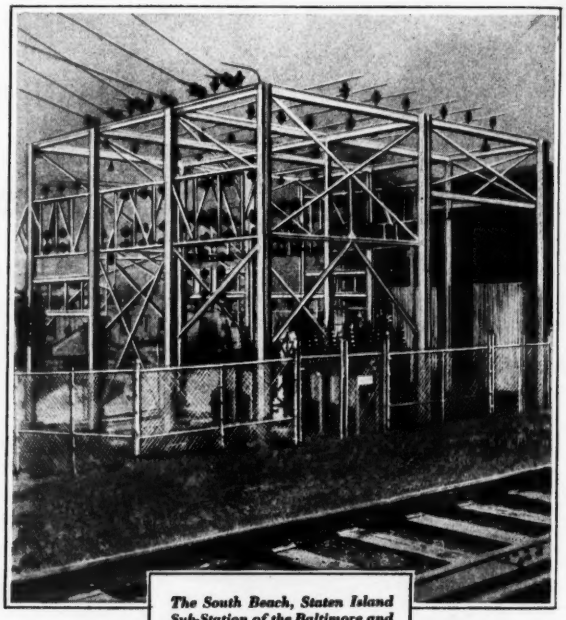

**Woolery Machine Co.**
**2913 Como Ave. S. E. Minneapolis, Minn.**

**TEAR OFF THIS MEMO COUPON NOW**

Woolery Machine Co., 2913 Como Ave. S.E., Minneapolis, Minn.
Please send me your free Data Book, "The Answer to the Railroad Track Weed Problem."
Name.....
Road.....
Position.....

# *For durability --visibility and economy--*

# ALUMINUM PAINT



*The South Beach, Staten Island Sub-Station of the Baltimore and Ohio Railroad (Staten Island Rapid Transit Division) is protected by Aluminum Paint.*

**ALUMINUM Paint is peculiarly adapted to the requirements of the Railroad Industry: it combines durability, visibility and economy.**

**The smoke, gases, fumes and rust ordinarily so destructive to exposed railroad structures are effectively resisted by Aluminum Paint. As the paint is applied it forms a non-porous film of metal over all surfaces of iron, steel, wood, brick or concrete which prevents the decay, "checking" and warping of wood, and the corrosion of iron and steel.**

**This "coat-of-metal" gives an extremely effective protection to high tension towers —electrical equipment of all sorts—at a cost no more than that of ordinary paint.**

**For signal towers, water tanks, bridges—all right-of-way equipment — the clean, silvery coat of Aluminum Paint also affords an extremely attractive appearance and high visibility.**

**The unique properties of Aluminum Paint are fully explained in the booklet, "Aluminum Paint, The-Coat-of-Metal Protection." It contains facts of importance to every Maintenance Engineer and Foreman Painter. May we send you a copy?**

ALBRON
ALUMINUM
ALUMINUM BRONZE POWDERS

TRADE MARK

*The pigment base for the better grades of Aluminum Paint is ALBRON made of pure ALCOA Aluminum.*

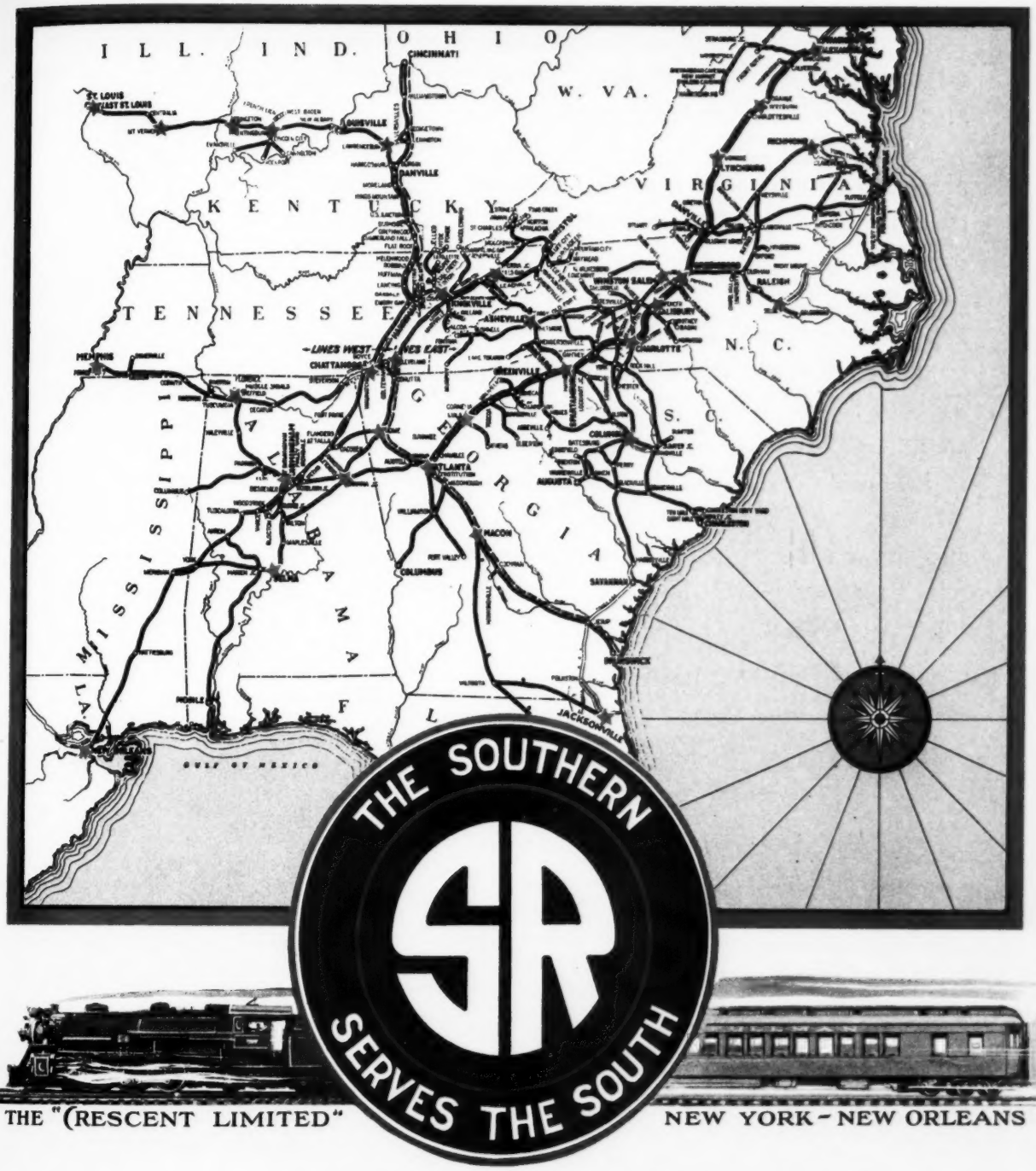
*In buying Aluminum Paint, tell your dealer how you propose to use it—and whether indoors or out. Most good paint dealers are prepared to furnish the kinds best suited to your needs. If yours is not, write us, giving his name and address, and we will see that he is supplied.*

**ALUMINUM COMPANY OF AMERICA**
**ALUMINUM IN EVERY COMMERCIAL FORM**
**2402 Oliver Building, Pittsburgh, Pa.**
***Offices in 19 Principal American Cities***

THE COAT OF METAL PROTECTION

# ALUMINUM PAINT

*"IT LEAFS"*




# ...and FAIRBANKS-MORSE serves the "SOUTHERN"

★ *The map above shows how completely the "Southern Serves the South"—the stars indicate Fairbanks-Morse Coaling Stations serving the "Southern"*

Better not linger on the right of way when the "CRESCENT LIMITED" is due, for she's always in a hurry. Back in her string of Pullmans, passengers enjoy an ease and luxury unsurpassed by any train in the world — but up ahead, the crew of the giant green-dressed

*(continued on next page)*

(*continued from preceding page*)

engine, checks landmarks against timepiece and "keeps her on the dot."

For the Southern Railway System fully appreciates the money value of *time*. It is the guiding thought of "Southern" personnel and is reflected in the high standard of "Southern" equipment.

Strung out over the Southern Railway System are 32 Fairbanks-Morse Coaling Stations to serve, speedily and economically, "Southern" locomotives. Complete service at these stations—coal, sand, water and cinder disposal.

Each of these stations was designed, constructed and erected by the Fairbanks-Morse organization. The undivided responsibility for their satisfactory operation rests upon Fairbanks-Morse.

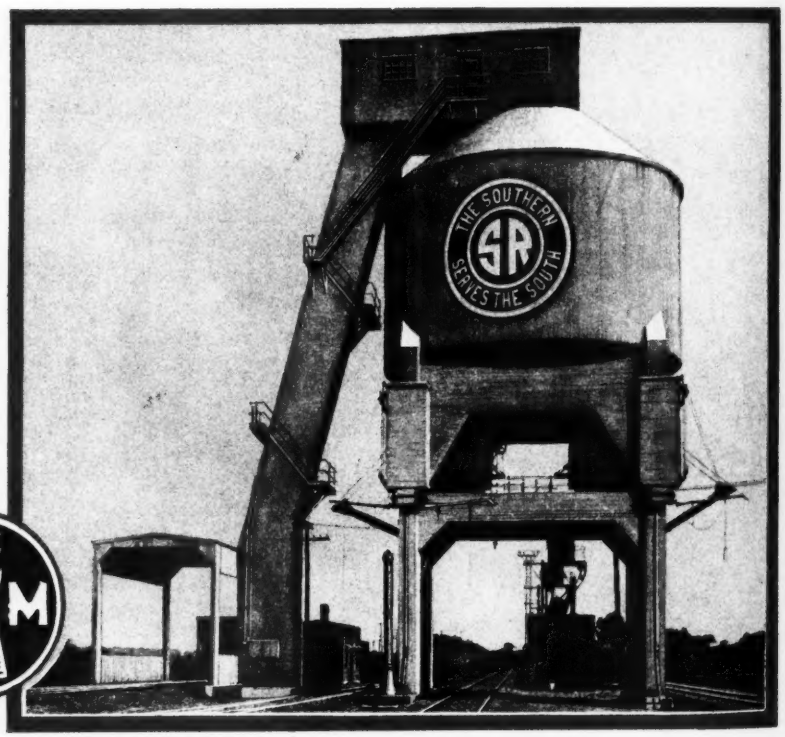
FAIRBANKS, MORSE & CO., *Chicago*

**Fairbanks-Morse Cinder Conveyors**

"Southern" locomotives are serviced completely by Fairbanks-Morse equipment—coal, sand, water and de-cindering equipment. Operating over one or more tracks, locomotives are de-cindered and cinders loaded into gondolas in minimum time. F-M cinder conveyors have many features which simplify layout and operation of terminal facilities.

**FAIRBANKS, MORSE & CO.**
*Chicago*

*Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; oil engines; steam, power and centrifugal pumps; scales; complete coaling stations and cinder conveyors*




*One of the 32 Fairbanks-Morse Coaling Stations on the "Southern"*

# FAIRBANKS-MORSE
# COALING STATIONS

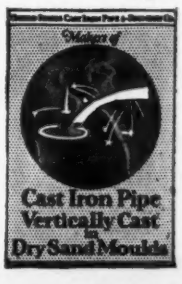
*Eight-inch Anthony Joint deLavaud gas pipe line suspended on bridge across Colorado River at Austin, Texas*

*To reduce installation costs Anthony joint pipe is available in 24-ft. lengths made up of two standard lengths welded and tested under ideal conditions at our plant*

# No leaks occur in *this* bridge crossing

EACH year there is added proof of the soundness of deLavaud cast iron pipe with the Anthony joint for gas and water service. The Austin Gas Co. installed the 8 in. deLavaud main illustrated above in 1926. Where this line crosses the Colorado River Bridge, conditions are unusually severe, due to peculiar strain and constant vibration. That leakage has never developed is practical evidence of the great tensile strength of deLavaud pipe and the flexibility of the Anthony joint.

In modern high-pressure gas lines this type of installation has proved widely satisfactory. Under daily pressures of 90 to 125 lbs. leakage can be practically eliminated. DeLavaud pipe gives pressure-proof tightness, combined with ease of installation, and the age-defying economy of good cast iron.




*MAY WE SEND YOU LITERATURE COVERING USES and LATEST SPECIFICATIONS OF DeLAVAUD CENTRIFUGAL PIPE*

## United States Cast Iron Pipe and Foundry Company

*General Offices:*
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*Pittsburgh:* 6th & Smithfield Sts.
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*Kansas City:* 13th & Locust Sts.
*Seattle:* 1st & Marion Sts.
*Minneapolis:* 6th Street & Hennepin Avenue

# You Need Not Gamble With Your Fence Dollars

BUSINESS executives, engineers, and architects often find a confusing similarity of details in proposals for chain link fence materials and erection. They can discover no assurance in specifications or samples that posts will stand rigidly erect, gates swing true without sagging, top rails run straight from corner to corner—after years of service.

How can anyone but a fence specialist sift out the vital factors that determine the life of fencing? Even with these factors at his fingertips, how can the buyer detect the hidden weaknesses of materials and erection which appear only after the price has been paid?

There *is* a way to be sure of full weight, high-grade materials and first-class erection: Call a Cyclone Fence Specialist and let him assist you in planning your fence. He represents a company which maintains unvarying standards of quality, carried through to the last detail of erection by its own employees under the direct control of the factory where your fence is built. This company dodges no responsibility. It assumes complete charge of the job from start to finish and stands responsible for the completed installation. Investigate this unified service before you let a contract. Write, phone, or wire nearest offices.

## Cyclone Fence

REG. U. S. PAT. OFF.



*Fencing for residences, estates, playgrounds, schools, factories, property of all kinds.*


CYCLONE FENCE COMPANY *Main Offices:* Waukegan, Ill.

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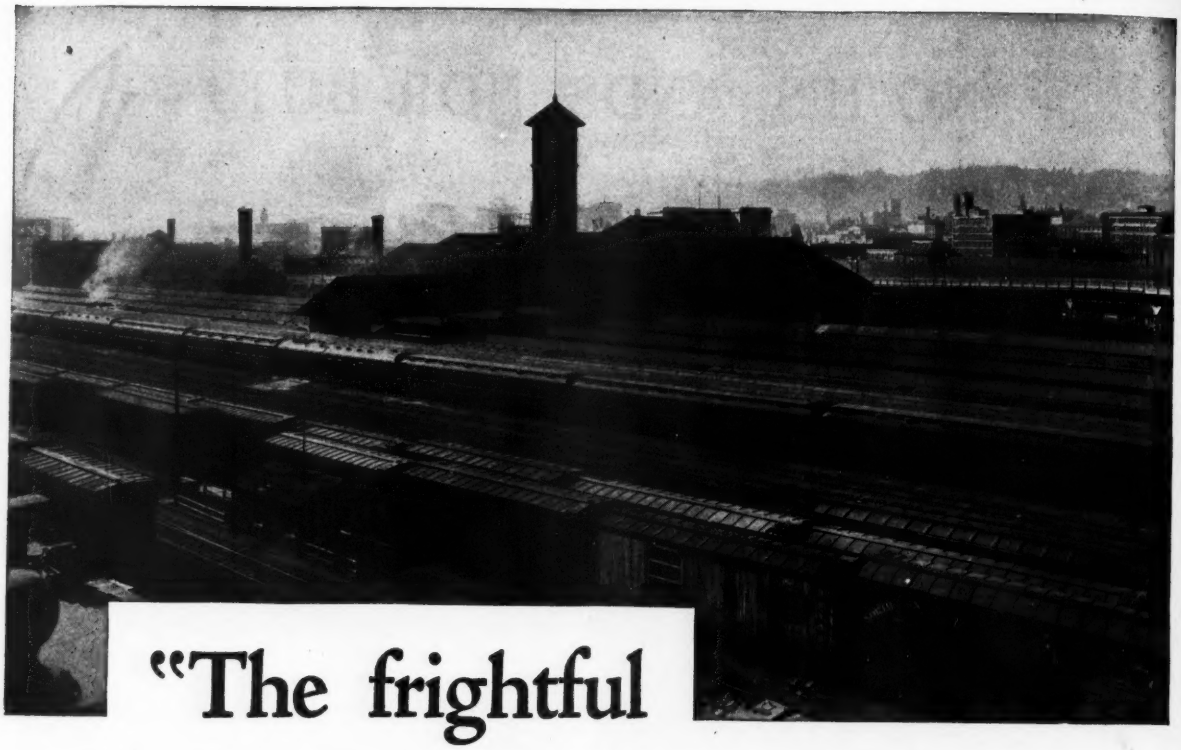
*Pacific Coast Division:* Standard Fence Company, Oakland, Los Angeles, and San Francisco, Calif., Portland, Oregon, and Seattle, Washington.



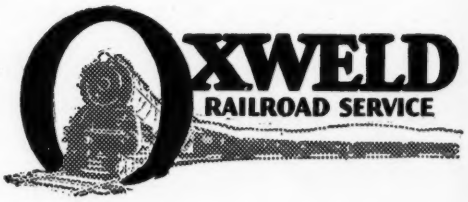
# "The frightful speed of 15 miles an hour"

THE MINUTES of a school board meeting held in Lancaster, Ohio, back in 1828, contain the following remarks: "If God had designed that His intelligent creatures should travel at the frightful speed of 15 miles an hour by steam, He would have foretold it through His holy prophets. It is a device of Satan to lead immortal souls down to hell."

Today fast express trains thunder by at the "unholy" speed of 70 miles an hour. Yet, during the twelve months of last year, out of the enormous total of 830,000,000 passengers carried, only ten passengers were killed while riding on trains. Can you think of anything that an American can do that is safer than riding on a passenger train?

The Oxweld Railroad Service Company has contributed to the remarkable efficiency of modern railroading. For 15 years it has been supplying the oxwelding needs of most of the important railroads of the country—eloquent evidence of the value of an Oxweld Service contract.

THE OXWELD RAILROAD SERVICE COMPANY
*Unit of Union Carbide and Carbon Corporation*
UCC
*New York City:* Carbide and Carbon Building
*Chicago:* Railway Exchange



PRETTYMAN PRESERVED
P28
FOREST PRODUCTS

# Timber Quality *worth* Preserving

ANY TIE subjected to Prettyman Preservation will last years longer than it would untreated. Impregnation to the heartwood with Grade 1 creosote oil preserves for 25 years and more the soundness, strength, toughness and elasticity that Nature gave it.

But only Nature can put these qualities into a tie. They must exist before they can be preserved.

A tie has to have them to meet the inflexible standards which govern Prettyman inspection and selection. It has to be worthy of Prettyman Preservation . . . of the definitely distinguishing Diamond-P hammer-mark before it enters the treating cylinders for permanization. For in this trade-mark rests the reputation of a name which for forty years has been synonymous with good timber.

It is the selection, therefore, of timber favored by Nature . . . the choicest of Southern Yellow Pine, nourished to the glory of perfection by the kindly soil of the fertile Carolina Coastal Plains, which is the real foundation of Prettyman Quality.

Prettyman Preservation clinches Nature's handiwork.

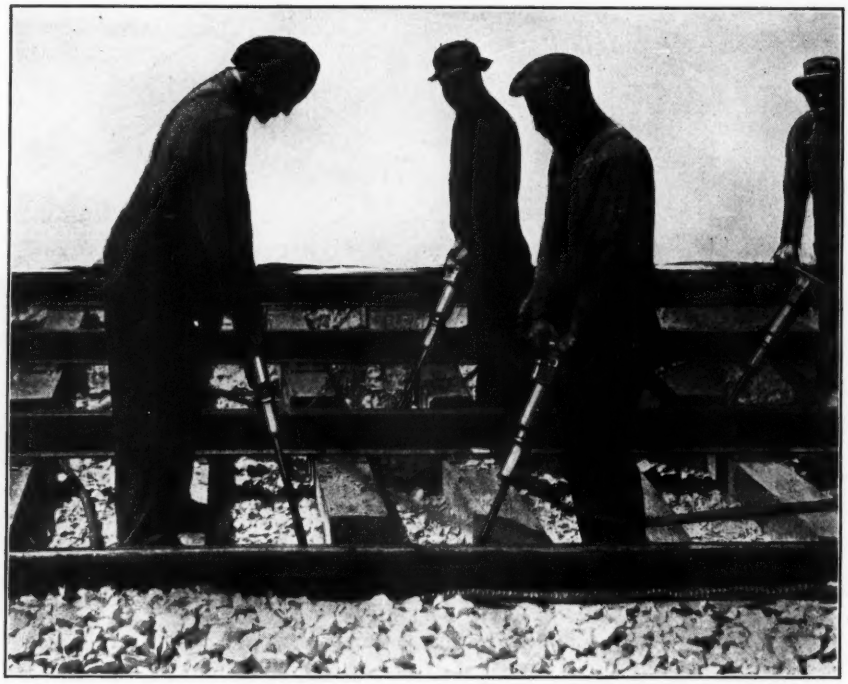
Prettyman Preservation renders accessible to railroads the economic advantages growing out of the low initial cost and the plentiful supply of Southern Yellow Pine by making it virtually permanent.

Regardless of the species of wood you are using for ties, either treated or untreated, Prettyman Preserved Ties of Southern Yellow Pine will cost you less per annum.

*Write for prices*

**J. F. Prettyman & Sons**
**Wood Preserving Plant**
**Charleston, S. C.**

# The New CP Tie Tamper



# Faster – Lighter Easier to Handle

TIE tamping has been simplified, speeded up and reduced in cost by the new CP Tie Tamper. SIMPLIFIED because the operator stands in an easy, natural position and complete control is under the palm of one hand. SPEEDED UP because the CP Tie Tamper is faster, lighter and easier to handle. REDUCED IN COST because the operator can do more work with less fatigue than with any other tool as the hammer is fully cushioned on both ends and practically vibrationless; an Automatic Throttle Valve shuts off the power when the tamper is lifted from one position to another, thus saving air and wear and tear on the tool which appreciably lowers maintenance.

*The New CP Tie Tamper is fully illustrated and described in folder 1646, sent on request.*

## Chicago Pneumatic Tool Co.

*Railroad Department*

6 East 44th St. New York | 1004 Mutual Bldg. Richmond, Va. | 310 S. Michigan Ave. Chicago

P-287

*Pennsylvania Railway Produce Terminal, Philadelphia, Pa.*


*Auction Room*

*View of interior of warehouse*

# CONCRETE
## Serves America's Leading Railroads

**The new fruit and produce terminal of the Pennsylvania Railroad in Philadelphia is another interesting example of the way leading railroads are using portland cement concrete in construction.**

**This terminal is the world's largest plant devoted exclusively to the fruit and vegetable trade. It includes three mammoth buildings, two of which are 126x800 feet, and one 110x500 feet; the team track delivery yard has a capacity of 510 cars.**

**All first floors, as well as a part of the second floors, are of portland cement concrete. The concrete platforms, eight feet wide, extend the length of both sides of the 800-foot buildings. The fireproofing for the structural steel columns, beams and girders is also of concrete.**

***Wherever railroad requirements demand construction of maximum durability, strength and economy, portland cement concrete merits first consideration.***

**PORTLAND CEMENT *Association***

*Concrete for Permanence* CHICAGO

# A Practical and Profitable LIGHT *UTILITY* Crane

Maintenance Departments will find the Buckeye *Utility* Crane applicable to a wide diversity of railway uses.

The fact that *it can be kept busy on some job or other, every day in the year, insures greater working capacity per dollar of investment.* Its versatility is emphasized by its ability to perform the work of several more highly specialized machines.

It is available in two mountings—*flanged wheels* which permit operation directly from the track or from rails laid on flat cars; and *Alligator (crawler) traction* for service independent of track.

Full revolving, it works in any direction. Heavy-duty, medium-speed industrial motor provides ample power for ordinary needs, with a reserve for emergencies.

Mass production of one standardized model enables us to sell the *Utility* Buckeye for $4800 f.o.b. factory, equipped with complete steel cab and flanged wheels.

Check its specifications and performance from our Crane Bulletin which will be sent upon request.


## Typical Specific Uses

1. Laying rail, including the unloading of new rail from cars onto the ground and the loading of old rail after it is released from the tracks.
2. Handling boxes, skips or clamshell buckets in service incident to the cleaning of stone ballast.
3. Handling the large variety of small excavation work, including its adaptability to the operation of clamshell, dragline, and orange-peel buckets within its capacity.
4. Handling heavy units such as frogs, switches, culvert pipe, etc., from cars to point of use.
5. Transfer of locomotive cinders from ash pits to cars for removal; transfer of coal from cars to locomotive tenders and from cars to storage piles and the reverse; the unloading of engine sand into sand houses, etc.
6. Unloading of concrete material such as sand and crushed stone from cars to storage piles at the construction site.

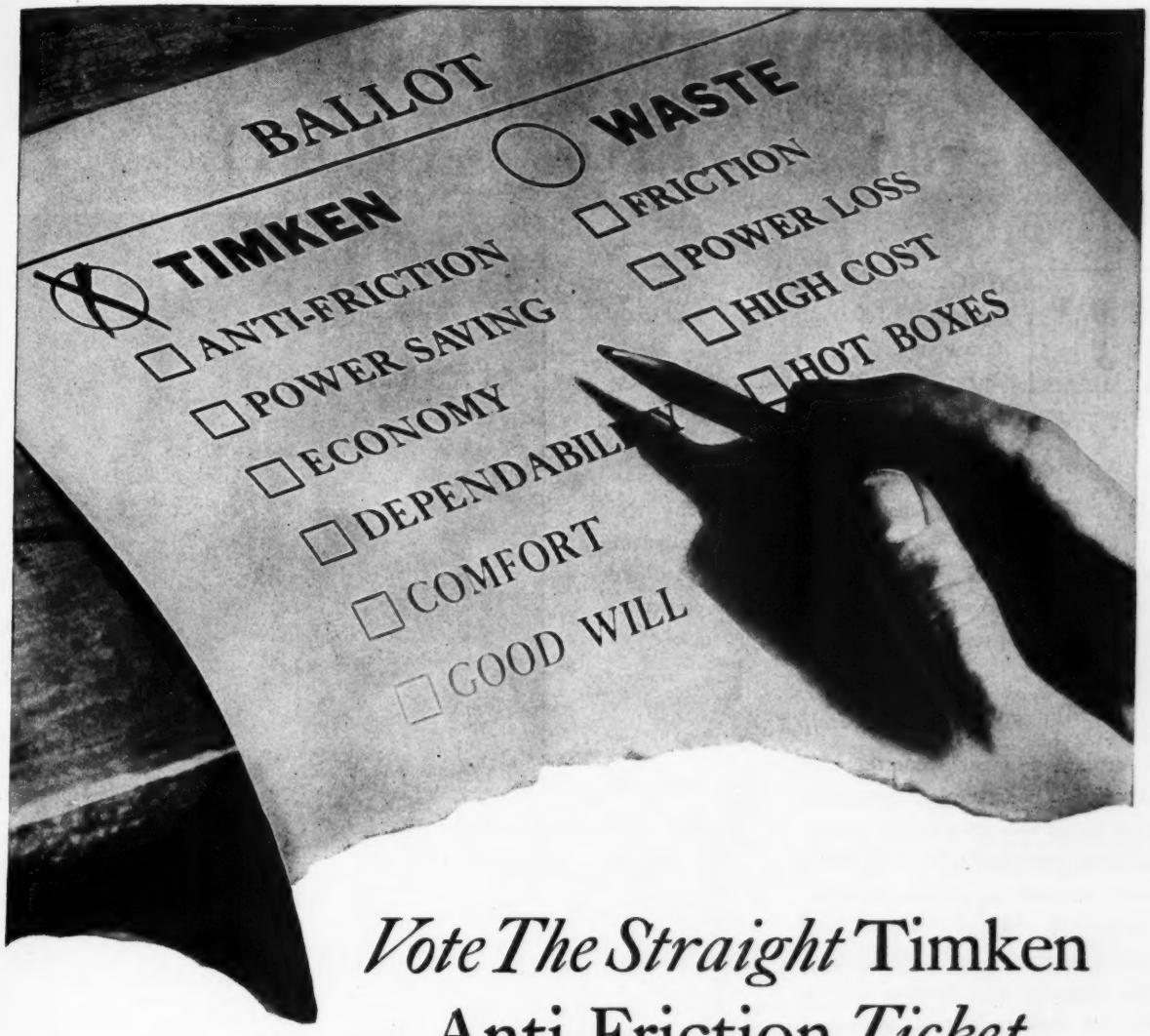
## THE BUCKEYE TRACTION DITCHER COMPANY

**Findlay, Ohio**

*There's a Buckeye Sales and Service Office near You*

*for over thirty years*

**Buckeye**




# *Vote The Straight* Timken Anti-Friction *Ticket*

Support the platform based squarely upon these sound planks—Anti-Friction, Power Saving, Economy, Dependability, Comfort and Good Will.

Railroads are vitally interested in placing Timken Bearings in rolling stock because Timken electric steel, Timken tapered construction and Timken *POSITIVELY ALIGNED ROLLS* act as a continual pledge of permanency.

This exclusive combination is well qualified to bring down maintenance cost, slow up depreciation, save power, eliminate jerking, increase riding comfort, and cope with radial-thrust load and shock from any and all directions.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

**TIMKEN** *Tapered Roller* **BEARINGS**

# *Buy your cement in these modern bags to avoid loss*

THE BEST form of cement insurance is buying your material in Bates Multi-Wall Paper Bags, the modern containers which resist moisture and rough handling with 5 separate walls of tough, pliable paper.

Bates Bags not only protect your cement against sudden showers, warehouse moisture and loss through bag breakage or sifting; they eliminate much clerical work because they need not be returned for credit.

Buy in Bates Multi-Wall Paper Bags and put your cement stocks on a no-loss basis.


*—no loss*

BATES VALVE BAG CORPORATION
35 E. Wacker Drive, Chicago, Ill.

# BATES *Multi-Wall* PAPER BAGS

Bates Multi-Wall Paper Bags are made by the Bates Valve Bag Corporation in 9 modern plants throughout the country


# What is Service?

You may know the answer so far as you are concerned. So far as we are concerned we know what the right answer is; and that's what we do.

Richards-Wilcox is primarily a service organization. We begin by making the highest grade door-hardware. We have within easy reach of every important point in the United States and Canada a staff of trained engineers, ready to give service on all door-way problems; they're often serious problems.

These engineers study your requirements and give you unbiased opinions. They know every door-way, from the one-car garage to the largest industrial doorway. They advise Richards-Wilcox hardware for doors because they know it's best; if they didn't know that they'd tell us so, and we'd improve it.

We're able to deliver such service because we're the largest and the only makers of door-hardware that will efficiently handle every door-way requirement. With us doorways are the first order of business.

Doors—in a building—are the only part of it that has to *work;* the rest of the building stands still.

***Don't experiment with doorway equipment. We've made all the experiments; we know. Our service is free. Write or call our nearest office.***

**Richards-Wilcox Mfg. Co.**

A Hanger for any Door that Slides

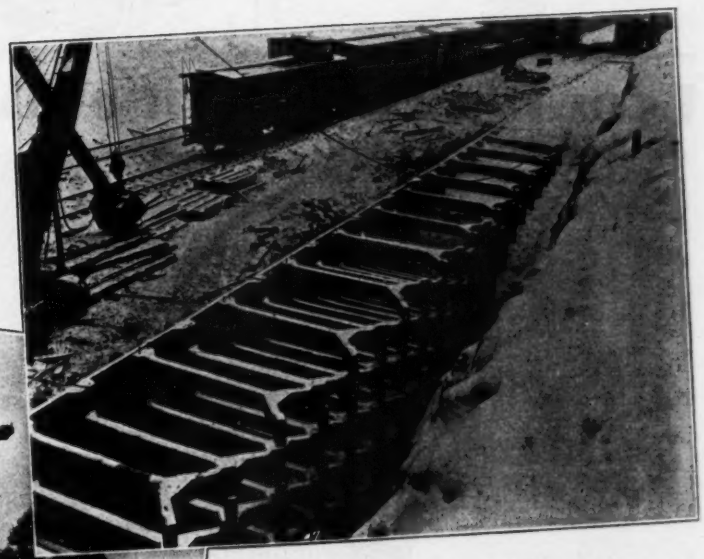
**AURORA, ILLINOIS, U.S.A.**

New York Boston Philadelphia Cleveland Cincinnati Indianapolis St. Louis New Orleans Chicago Minneapolis Kansas City Los Angeles San Francisco Omaha Seattle Detroit

Montreal · RICHARDS-WILCOX CANADIAN CO., LTD., LONDON, ONT. · Winnipeg

# In Place - Speedily

## Winter or Summer



*A typical winter installation of a Federal precast concrete retaining wall.*

*Laying a Federal wall in summer.*

It's so simple to lay a Federal retaining wall!

No foundations are necessary—no costly excavation—no form work or other preparation.

There are only *two units* to handle—and they are unloaded direct from cars to wall. Ordinary labor can do it by hand—a hoist speeds up the job.

Since the precast units come to the location ready to lay, the wall can be erected under any weather conditions—as readily at zero as in summer heat. It may also be re-located at any time with 100% salvage.

Federal has won unusual recognition from railroad, highway, and industrial engineers throughout the country. The combination of the low cost of its 2-unit design—speedy erection—rugged strength and stability—elimination of all maintenance—and particularly the clean-cut beauty of its *closed face* — give Federal a tangible plus value over all other constructions. Booklet "The Ideal Retaining Wall" gladly sent on request.

**FEDERAL CEMENT TILE COMPANY, 608 South Dearborn Street, Chicago, Illinois**

*Concrete Products* *for Over 25 Years*

# FEDERAL 2 piece Concrete CRIBBING

# Strenuous Service Demands Unusual Steel

## *, , Have you Given Full Consideration to Alloy Steel?*

The very qualities that have given alloy steel its present standing in the field are the ones most needed in certain locomotive parts. In railroad service, toughness, strength and durability and resistance to shock and fatigue reflect themselves in increased operating efficiency, decreased time out of service and lower maintenance costs.

It is impossible to consider a program of reduced costs without a full study of alloy steel. In such a study our alloy engineers will gladly co-operate without cost or obligation.

**Illinois Steel Company**

General Offices: Chicago

**ILLINOIS *Alloy* STEEL**

# Only CYPRESS will serve for Matthews switch boxes

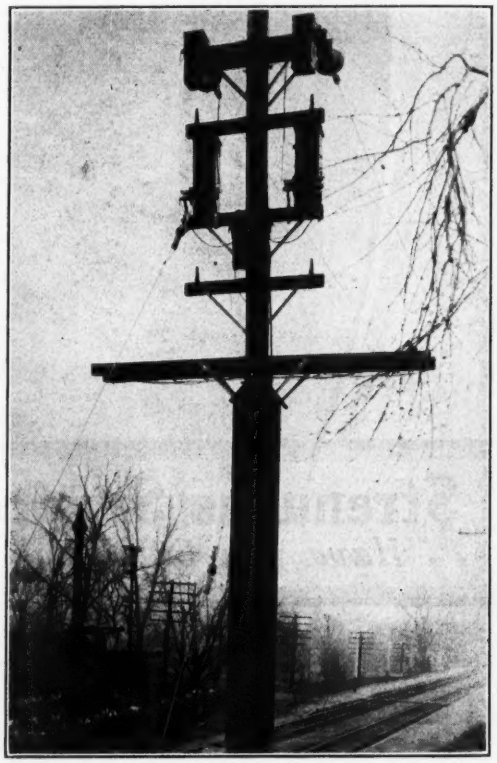
SWITCH boxes lead a hard life. They get little rest in their battle against the weather. So they must be built of wood that moisture doesn't bother.

Because dependability is the first, last and foremost consideration in the products they manufacture, the W. N. Matthews Corporation of St. Louis uses Tidewater Red Cypress in all of its switch boxes.

This large manufacturer has found that Tidewater Red Cypress resists moisture, fights off rot, is easy to fabricate, permits fine workmanship, and finishes smoothly.

Railroads are using more and more of this Wood Eternal each year. They employ it for passenger station construction, freight sheds, warehouses, platforms, conduits, water tanks, cars, fencing, and every other place where upkeep must be cut down.

Complete information on this long-lived wood will be sent free on your request. Write to Southern Cypress Manufacturers Association, Dept. R E 11, Jacksonville, Florida.



*Matthews Fuswitches for transformer protection on automatic train control system. Above is a type HQ Matthews Fuswitch in a box built of durable Tidewater Red Cypress.*

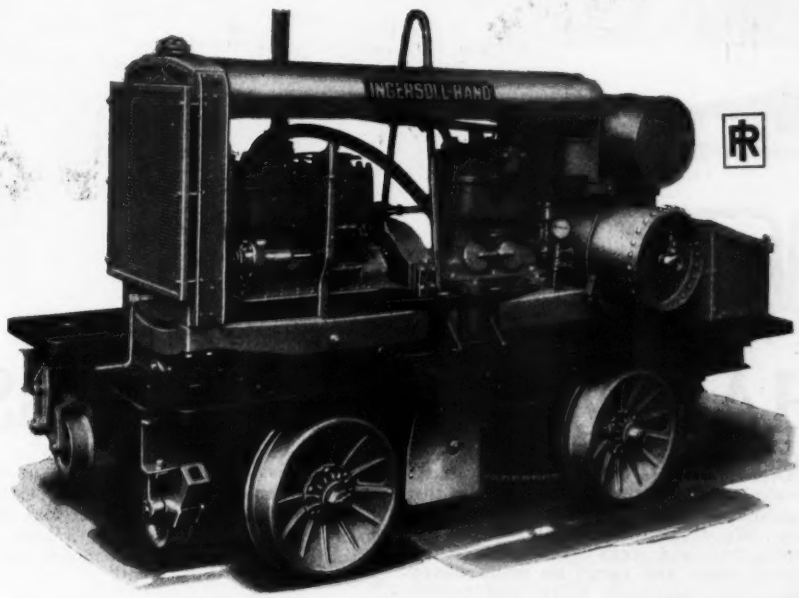
*Specify* TIDEWATER RED CYPRESS

THE WOOD ETERNAL

# *The Product of 14 Years' Experience in Building Tie Tamper Compressors*

Ingersoll-Rand is the pioneer in the development and introduction of labor-aiding compressed air equipment for track construction and maintenance. Its long experience has made possible numerous improvements and refinements in its compressors and tools —improvements which now make them the greatest value yet available.

Furthermore, by reason of this long experience, the Company is in a position to render a superior service, and to give complete instructions regarding the organization of gangs and the care and operation of the units.




Ingersoll-Rand machines for track construction and maintenance include Tie Tamper; Compressors of 4-tool, 8-tool, or 12-tool capacities; also a wide variety of labor-saving compressed air tools. There are Spike Pullers, Spike Drivers, Bonding Drills, Rail Drills, Tie Tampers, Pneumatic Wrenches, Woodborers, Riveters, Safety-First Air Saws, Hoists, Rock Drills, and Grinders. Ingersoll-Rand can, therefore, furnish complete equipment for many classes of work.

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# AT IT HAMMER and TONGS

CHANGING rails on main lines or busy terminals calls for quick action by the gangs and the use of good dependable track tools. Woodings sledges, chisels, tongs, tamping bars and picks increase efficiency of track labor and speed up maintenance work. They eliminate delays and permit tracks to be turned over to the operating department on schedule time.

The high quality in Woodings tools is no chance occurrence. Behind it is the choice of the very best grades of steel obtainable and the master skill of expert workmen who have made a lifetime study of making tools and who never deviate an iota from the most exacting specifications. Each tool is subjected to rigid tests and critical inspection.

Time tells which tools excel. Woodings tools have proved their fitness by years of reliable service. Repeat orders from constant users prove their fitness to stand up under long and hard service.

*A trial test will convince.*

**Woodings Forge & Tool Co.**
*Works and General Sales Office*
**Verona, Pa.**

# WOODINGS
## STANDARD TRACK TOOLS

*A Partial List of Railroads using*
UNIVERSAL PIPE

PENNSYLVANIA LINES
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DELAWARE, LACKAWANNA & WESTERN
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CANADIAN PACIFIC RAILWAY
BOSTON & ALBANY
BOSTON & MAINE
CENTRAL VERMONT
CHICAGO AND NORTHWESTERN
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# Eleven Years of Service As Good as New

This 8-inch Universal Pipe water supply line at Remount, Texas, laid eleven years ago, continues to give dependable uninterrupted service.

Nothing to deteriorate, nothing to work loose.

Wrenches the only tools needed to make these tight, flexible, iron-to-iron joints.

The contact surfaces of the hub and spigot ends are machined on a slight differential taper making a natural iron-to-iron joint that amply provides for expansion and contraction, vibration and uneven ground settlement.

Approved by the Underwriters Laboratories which are under the direction of the National Board of Fire Underwriters.

Let our nearest office show you why Universal Pipe for water supply, fire protection and other service is so much easier—quicker—safer . . . .

UNIVERSAL CAST IRON PIPE
No bell holes to dig: No joints to calk
THE CENTRAL FOUNDRY COMPANY
*Subsidiary of* The Universal Pipe and Radiator Company
Graybar Building, 420 Lexington Avenue
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# Long Life— True Gage

THE job of a guard rail is to confine one wheel flange in a narrow channel and so prevent the other flange from hitting the frog point. The very nature of this service gives rise to a great amount of abrasion and, where traffic is congested, this abrasion and wear means constant adjustment of the ordinary guard rail in order to maintain correct gage.

Manganese steel, with its ability to resist wear and shock, is, therefore, used for the construction of the Ajax One-Piece Guard Rail. It has maximum wearing qualities and resiliency. The throat is so shaped, as determined by long experience, to guide the flange into the proper position with the least possible shock.

The Ajax Guard Rail is fastened direct to the ties and the gage distance is maintained independently of the stock rail gage. Long and broad spiking surfaces give good spacing for the spikes and plenty of bearing.

A guard rail made in one piece without any loose parts reduces maintenance work and cost to a minimum. The Ajax guard rail is the pioneer one-piece guard rail.

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Railway
Engineering and Maintenance

Volume 24 November, 1928 No. 11

## What is Your Safety Rating?

WHILE advocating and acting safety are now well established practices in all departments of the railways, it is evident from the extended discussions at the meeting of the Steam Railway section of the National Safety Council in New York on October 2, 3 and 4, that no one, apparently, is satisfied that the present conditions, good as they are, cannot and should not be improved upon. In this, no one excepted the maintenance of way department, or any part of its organization, from the track foreman to the highest officer. Each has his responsibilities, and it was pointed out that, instead of decreasing, these responsibilities are constantly increasing as the problems of maintenance become more complicated and exacting. Many of these responsibilities of both maintenance officers and their supervisory forces, including foremen, were set forth clearly in papers presented at the council's meetings.

Significant among these responsibilities are certain of those charged to the higher officers, in whose hands, to a large extent, rests the welfare of large units of the maintenance forces. Many in the maintenance department have done much for safety, but if there are any maintenance officers or employees who think that they have gone the limit to promote safety, it would be well for them to appraise their standings in safety work carefully and honestly.

## Co-operation Between Departments

THE increasing recognition of the value of co-operation between the different departments of the railways, especially those most intimately concerned with the upkeep of the physical property and the conducting of transportation, is evidenced in the committee reports of the two associations composed of supervisory officers in charge of the roadway and track and of the bridges, buildings and water service —the Roadmasters' and Maintenance of Way Association and the American Railway Bridge and Building Association. At the recent conventions of these organizations the importance of co-operation with other departments was stressed in almost all of the reports, as was also the desirability of the programming of work, which, in itself, is an aid to co-operation, since a properly prepared program should take into account not only the department by which the work is to be done, but also the effect it will have on the work of collateral departments.

This co-operation has been made all the more necessary with the increasing use of mechanical means for performing work which was formerly done by hand labor. Some of these machines, from their nature, are restricted to certain tasks, while others may be used interchangeably by the various departments in charge of the maintenance of the property. Thus, for example, cranes of either the track or crawler types may often be used to advantage by either the track, bridge, building or water forces, and the same is true of portable power plants and air compressors. Since the value of the machine is largely dependent on the number of days of service which can be secured from it during the year, the programming of work for the different departments, whereby such machines can be kept in use, will result in distinct economies. This cannot always be done, but its possibilities should be considered.

The day when each department was sufficient unto itself, when the men in any one department were trying "to get the best of the fellows in the other department," has passed. Much of the credit for this must be given to the supervisory officers in charge of the maintenance of way, structures and water service, whose efforts toward co-operation with each other and with the transportation department have done much to bring about the enviable operating records that have been made by the railways of the American continent.

## Motor Trucks

MANY railway employees are profligate in their use of passenger transportation because of their feeling that "it costs nothing." They hold largely the same attitude regarding the use of locomotives and cars for the movement of the materials required in their various operations. It is only within recent years that appreciable attention has been directed toward the cost of such service and as its magnitude has become more generally realized, a search for alternate methods has gained momentum. From this has come an increase in the use of motor trucks.

These trucks have received their first and widest application within terminal areas. It is here that the largest quantities of materials are required by engineering and maintenance forces for repair and improvement work. It is here also that work trains operate under the greatest handicaps. Furthermore, the network of city streets ordinarily makes it possible for a truck to reach almost any part of the terminal. In many such locations, trucks have almost entirely replaced the work train while by the extension of hard roads through the rural sections, their radius of action has been increased correspondingly.

The first result of the installation of trucks for the handling of company materials has been a marked reduction in the cost of this work, the saving being

placed at $1,000 per truck per year by several roads in a report presented before the recent convention of the American Railway Bridge and Building Association, or sufficient to pay for the truck in two or three years. Of at least equal importance is that the materials are distributed more promptly and maintenance operations expedited, while the truck gives greater flexibility to a job since men and materials can be transferred from one point to another on very short notice.

The motor truck has established a secure place for itself in industry. The same characteristics which make it of value outside of railway service can be utilized by the roads themselves for their own operations. Engineering and maintenance officers owe it to themselves and to their roads to study the possibilities of the motor truck for their operations and to utilize it wherever it will produce economies, in the same manner that they are going so largely into the use of other equipment to reduce the cost of their work.

## We Have Come Far

"IF THE hind truck of a car should be broken or rendered useless . . . . remove the truck and let the car down on a tie and by running carefully it may be hauled to a station or side track, sliding it on the tie . . . . If sliding is not practicable, block up both ends of the car on ties, move the forward truck under the rear end of the car and haul the car with the front end resting on the coupling [hanging from the link]."

This statement, taken from the "Trackmen's Helper" which was published in 1894, paints a picture of railroading 30 years ago which stands out in vivid contrast with the present. What comes to mind first is the marvelous increase in the weight of railway equipment since that time. It seems almost inconceivable that cars were once so light that one end could be carried on a coupling link. But the real significance of the picture is in the portrayal of the primitive methods with which work was conducted. In the entire chapter on wrecks from which the above quotation was taken, only one mention is made of a derrick car or crane, and that an indirect one. In the days when track forces had a direct part in the clearing of wrecks with little or no equipment other than a few hand jacks and a chain or cable hooked into the coupling of a locomotive, the idea of power equipment for the work ordinarily done by track gangs, was entirely undreamed of.

## Getting the Most from the Pay Roll

IN VIEW of the care with which maintenance officers specify and inspect the materials they use to insure that they accept only those which will give them the greatest return per dollar of expenditure, it is difficult to explain the more or less haphazard manner in which they make still greater expenditures for the labor employed to use these materials. This is true particularly of the section forces. It is true of course, that these men work in small gangs, making supervision difficult. It is true also that their work is varied. Yet these conditions only add to the necessity for care in making the expenditures for their wages, especially since these forces account for the larger part of the maintenance payroll.

The first essential of any successful plan for the efficient administration of forces such as these is the development of some means for the measurement of the performance of each gang. On a few roads, notably the Chesapeake & Ohio, this is done by means of detailed cost studies of the operations of each gang. More commonly, an effort is made to give gangs equal work and to determine their relative efficiency by comparing the standards of maintenance of their respective units. The real value of such a method depends of course on the accuracy of the division of the work among different gangs. Ordinarily these limits are established by rule-of-thumb methods, which may be reasonably accurate but which are sometimes grossly inaccurate. Comparisons based on them are correspondingly misleading and unfair, a fact which is recognized to an extent which tends to discount the benefit to be derived from them. If these sections can be equated equitably, however, a basis is provided at once for the detection of inefficiency and the initiation of the requisite corrective measures.

That such a method is not simple is admitted. This, however, is no reason why it should not be undertaken. That beneficial results can be attained is evidenced by the study made on the Eastern division of the St. Louis-San Francisco, as related on page 475 in this issue by J. M. Sills, formerly division engineer of that division. While the equations developed by Mr. Sills apply only to the conditions existing on that division and to the standards of maintenance in effect there, the methods which he adopted in the development of his equations apply with equal accuracy elsewhere.

The railways of this country spend more than $450,000,000 annually for labor for the repair of their tracks and structures, or at the rate of approximately $1,500,000 per working day. The expenditure of such a sum warrants the closest analysis to insure that it is made with the greatest efficiency and that the maximum returns are secured therefrom. These expenditures are deserving of more attention and analytical studies by maintenance officers than they are receiving today. Those officers will promote the interests of their roads most who will give these expenditures for labor the closest analytical study.

## Are Daily Records Worth While?

WHEN a road, over a period of three years, has so readjusted its practices as to reduce the cost of a major item of maintenance work by twenty per cent, it is of general interest to maintenance officers to note what may have brought about this economy, and particularly so when the resulting saving for a single year increases to the point where it can be expressed in six figures.

With this thought in mind, there is presented elsewhere in this issue, a description of the extensive ballasting work which has been carried on by the Boston & Maine during the last three years, and a study of all of the factors which have entered into the large reduction effected in the cost of this work. In the main, the greater effectiveness of the work is attributed to four factors; a more carefully prepared program, the more effective arangement and use of mechanical equipment, closer supervision, and a closer check of the work accomplished and the costs incurred. While due weight is given to all of these factors in increasing the efficiency of the Boston & Maine's ballasting work, it is significant that officers of that road should point to that factor which is possibly the least generally recognized and applied, and say that therein lies the major reason for the effective results accomplished. The factor

referred to is that of a closer check of the work accomplished and the costs incurred each day.

Many roads prepare definite programs for their larger items of maintenance work and are convinced of the advantages of labor-saving equipment, but when it comes to keeping informed daily as to whether they are securing the most effective results from their expensive organizations and equipment, they are content to let that show up at the end of the season, trusting that the showing will be favorable. The Boston & Maine has learned that that is too late, and that a constant check on the progress and cost of work enables opportunities to be seized for refinements in methods and organization which are otherwise completely lost. With this lesson learned, all major items of maintenance work on that road are being planned and carried out on a "know your progress and costs" basis. The economies being effected in its ballasting program are, therefore, indicative of the economies which are being effected in its maintenance work as a whole. The Boston & Maine is one of a considerable number of roads which, in recent years, have been giving more attention to this phase of maintenance work and expenditures, but there are still roads which lag in this respect. It is to be hoped that such roads will soon begin to realize the expense of their neglect, and derive some stimulus in this direction from the experiences of the Boston & Maine.

## When "Rush" Means Rush

WHEN emergencies become everyday occurrences they cease to attract attention. Any measure which is intended to direct attention to an emergency condition should, therefore, be guarded carefully to be sure that it is not so employed as to destroy or lessen its value. Such a warning is the term "Rush" on a requisition.

The conditions under which the railways are maintained and operated are such that occasions arise frequently where materials are required with the minimum delay. Washouts, wrecks, fires and other unforseen accidents, as well as sudden changes in traffic conditions, require the replacement of or change in facilities without warning. Under such conditions the placing of the notation "Rush," on requisitions is a proper characterization of the need for the material and it is as much the duty of the stores department to comply with this instruction as it is the responsibility of the engineering department to use the supplies promptly when furnished.

There is another condition under which this term is used frequently. This arises when the man on the job awakens to the fact that he has overlooked some essential material or finds at the last minute that it has been shipped incorrectly. While such a condition may be no less pressing than that cited above, it constitutes a reflection on the man in charge of the work in the field, for it brings to light a situation that could have been avoided if proper care had been taken, and thrusts an unnecessary burden on the stores department if delay is to be avoided.

There is still another and even less excusable practice, where the maker of a requisition marks it "Rush" to insure that the material will be on hand when needed even though there may be ample time for its delivery in the regular manner. Such a practice is effective only until the stores department learns of its abuse, when it ceases to have any influence. The result is that when a real emergency arises or material is needed badly, the stores department has no way of distinguishing between a requisition made under such circumstances and the similarly marked but less urgent one, with the result that it receives only routine attention. This is obviously an objectionable condition which may court disaster.

While the responsibility for any delay resulting from the ignoring of a rush requisition for materials rests with the store department, this responsibility can only be maintained when the notation "Rush" is properly warranted. The abuse of this notation by its too frequent and unwarranted use lessens, if it does not entirely annul, the responsibility of this department. The remedy is obvious—to insist that those who prepare requisitions note thereon the dates on which the materials will actually be needed and confine the notation "Rush" to those of a real emergency character.

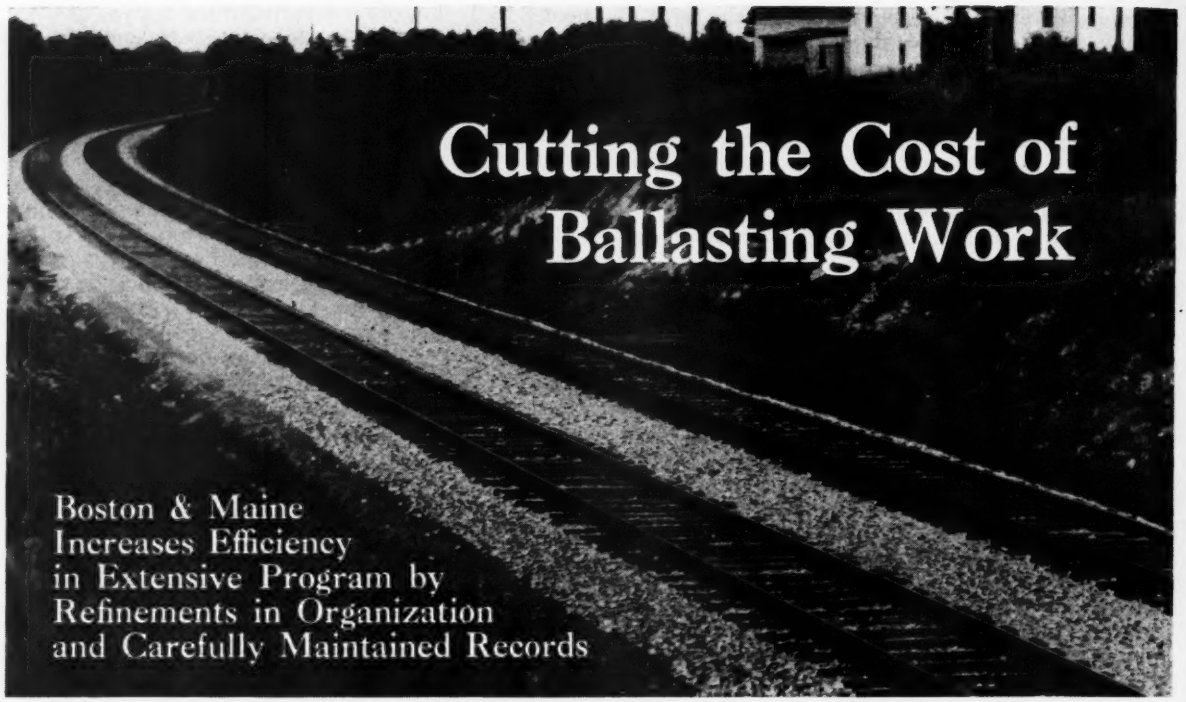
## Shimming Track

THE AVERAGE officer of track maintenance in a territory where winters are mild, is inclined to consider shimmed track an evidence of poor or indifferent maintenance, a condition which might be tolerated on a minor branch but which would have no place on any high-grade main line. If he has had experience with heaving track at all, he knows that this phenomenon is encountered where the moisture in the ballast or roadbed becomes frozen; consequently he feels that proper drainage should overcome heaving and make shimming unnecessary.

This attitude is due to a failure to realize what an enormous problem heaving track imposes on the maintenance of way organization in territory subject to extreme low temperature during long periods. There the frost penetrates far below the bottom of the ballast, and roadbed drainage in the ordinary sense is by no means a cure for heaving. As a consequence, track of a character which would give no trouble at all in the latitude of New York, Chicago and Omaha, will often require much shimming in Canada and in the northern tier of the American states. In these regions shimming is a regular part of the winter work, for which detailed preparation is made each fall. Shims in ample quantities are distributed and carefully stored at suitable intervals along the track.

Experience with heaving track, like any other detail of track maintenance, makes possible a high degree of skill and judgment in meeting the problems which it imposes. As a consequence, trackmen who are regularly confronted with this situation, are readily able to shim heaving track in a workmanlike manner and with entire safety.

Shimming, of course, comprises an exceedingly expensive method of surfacing track. It is expensive not only in labor but in material. Of particularly serious consequence, is the damage done to the ties by the repeated driving of spikes. So serious is this phase of the problem that the use of treated ties on some tracks particularly subject to heaving cannot be justified, as the life of the ties is terminated by spike killing rather than rot. Therefore, while shimming is a practice which is virtually inevitable on lines in certain territories, efforts are constantly being made to reduce the need for it where this is practicable. The careful marking of those places in the track subject to the most severe disturbance during extreme low temperature, with a view to the correction of the underlying causes at the first opportunity, is the primary step toward a cure.



# Cutting the Cost of Ballasting Work

## Boston & Maine Increases Efficiency in Extensive Program by Refinements in Organization and Carefully Maintained Records

*A Section of Completely Reballasted Track on the B. & M.*

EACH YEAR since 1925 the Boston & Maine has undertaken an extensive ballasting program in an effort to keep pace with the heavier power being placed in operation and the other extensive improvements which are being made on its property. This year the ballast program calls for the complete ballasting of more than 100 miles of tracks, and so effectively is the work being planned and carried out that the forces are not only far ahead of the carefully planned schedule prepared on the basis of previous performance but are also doing the work at a marked reduction in cost. The efficiency being displayed in this year's work is attributed to four major factors—the carefully planned program, the effective arrangement and use of mechanical equipment, adequate supervision over the men employed in each operation of the work and the up-to-date and carefully prepared records which are being maintained with respect to the amount of work done and the costs incurred.

### Scope of the Program

Owing to conditions beyond its control, it has not been possible, until recent years, for the Boston & Maine to undertake other than a limited amount of local ballasting in connection with its regular track maintenance work. The present large ballasting program is general, rather than local, in its scope. In 1926 the major project included the ballasting of the double track between Malden, Mass., near Boston, and Lawrence, on the westerly route between Boston and Portland, Me. This included about 44 single-track miles. In 1927 the ballasting work was carried forward on the same line, from South Lawrence to Salmon Falls, N. H., and included 90 single-track miles.

During the present year the program includes the ballasting of 67½ additional single-track miles on the same line, from Salmon Falls to Rigby, Me., near Portland, and 43 single-track miles, between Winter Hill, Mass., near Boston, and Lowell, Mass., on the main line from Boston to White River Junction, Vt. The current program also includes the ballasting of three single-track miles between Malden and Wellington, Mass., extending the work which was stopped at Malden in the 1926 program. As planned, therefore, the 1928 program includes the ballasting of 113½ single-track miles. When this is completed the entire west route of the Boston & Maine from Boston to Portland will be on a new, full-ballasted section.

### Use Both Stone and Washed Gravel

In all of this work, as was the case in the ballasting during 1926 and 1927, crushed stone and washed gravel are being used, the selection of material being based on the availability of the material in the locality of the ballasting work. On this basis crushed stone is being used between Winter Hill and Lowell, between Salmon Falls and North Berwick, and between Wellington and Malden, while washed gravel is being used on the double track between Kennebunk and Rigby, where this material is readily available.

Both classes of ballast being used by the Boston & Maine are in accordance with A. R. E. A. specifications, and in each case the standard ballast section being adhered to provides a depth of 8 in. of ballast beneath the ties, and a shoulder of 25 in. beyond the ends of the ties, from which point the ballast is sloped on a 2 to 1 slope to the toe line.

Along with the ballasting work, the entire track structure is being overhauled, this including tie renewals and the widening and cleaning of ditches in order to improve drainage and thereby secure the full effectiveness of the new ballast. This auxiliary work is, however, done by separate forces, and records of its cost and amount are kept entirely separate

from the records maintained on the fundamental operations involved in the ballasting work.

All of the various operations involved are carried out under traffic. Each operation is well defined and each group of men on the work forms a definite part of a carefully planned organization. The first operation involves the removal of all of the old ballast from within the tie cribs, this work being done by hand shovels. Material thus excavated is thrown over the outside shoulder of the roadway or into the inter-track space. An American ditcher equipped with a specially designed skew dipper trenches out between the tracks.

When in cuts, or in or about station grounds, the material is loaded on cars and moved away for use in widening shoulders. Ordinarily the material in the cribs is dug out only to the bottom of the ties, care being taken not to disturb the old roadbed. The only exceptions to this practice occur at bridges or at certain rail or highway crossings where the old grade line must be maintained, and where it is necessary, therefore, to disturb the old roadway in order to place new ballast under the ties. In connection with the cribbing work, the old track centers of about 12 ft. are being widened to a minimum of 13 ft. wherever possible.

### Distributing the New Ballast

About two days following the removal of the old ballast new ballast is distributed over the skeletonized track in a quantity sufficient to provide for the full ballast section to be established. This is done by work trains of hopper cars, the stone or gravel being released from the bottom doors and spread over the track by two ties placed on the rails against the rear truck wheels of each car.

Raising of the track follows about two days behind the distribution of the ballast, this being done by a distinct group in the ballasting organization. In all of this work it is the practice to make the full lift in a single raise where such a lift does not exceed nine inches, and to resort to double raising only in sags or at other points where a lift exceeding nine inches is required. Track jacks are used in all of this work, and it is the practice to bar-tamp the ties at joints, and at the center and quarter points of each rail, only roughly tamping the remaining ties in the track. In making the full lift the track is brought up to the level of ballast stakes set previously by the engineers of the maintenance department. During the course of this work, and for about two or three days following it, the track is left open to traffic, this means being utilized to secure further compacting of the ballast preliminary to final surfacing.

### Tamping Force Covers 8,000 Ft. of Track

Following the raising work and the traffic tamping of the new ballast, final surface is given to the track by a force equipped with four Ingersoll-Rand 12-tool tie-tampers. In this work the track is disturbed only enough to bring it back to the level of the ballast stakes. In carrying out the work, all four of the 12-tool tamper compressors are used on the tracks being raised, and as the work progresses, they are moved successively about 2,000 ft. in advance of each other, each change of position involving a move of 4,000 ft. in double-track territory. This wide spacing of the compressors is made possible through the use of a special air piping arrangement, which not only minimizes the number of times that it is necessary to move the units and to provide new set-offs, but also minimizes delays in the operation of the tamping tools.

In the piping arrangement employed each compressor is equipped with a 1,000-ft. pipe line of 1½-in. black steel pipe, which is made up of fifty 20-ft. lengths. In this line the 20-ft. lengths are joined in groups of three each by means of standard pipe couplings, and the successive three-length sections are joined together by short lengths of standard 1¼-in. air-brake hose fitted with standard air-brake connections. In addition, each of the three-length sections of the main pipe line is fitted with a right-angle take-off, which is provided with an air cock and a short section of air-brake hose with a coupler head at the end. This arrangement makes it possible

All of the Track Is Completely Skeletonized

**Each Ballasting Organization Is Equipped with 48 Tamping Tools**

to tap the air line at intervals of about 60 ft. and does away with the necessity for long, awkwardly-handled hose connections to the tamping units.

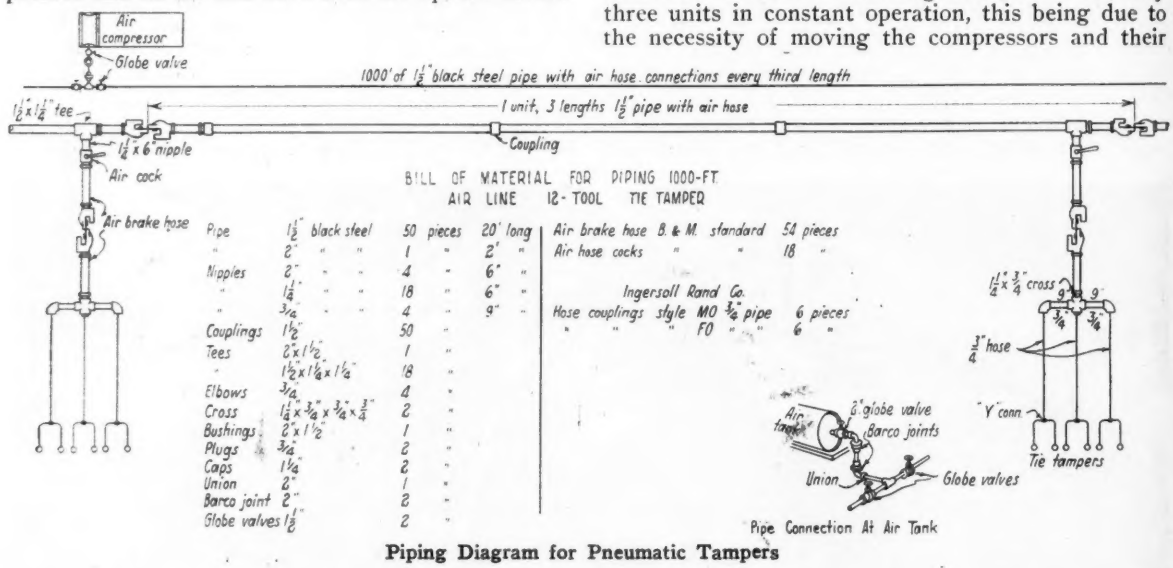
### Place Compressors 2,000 Ft. Apart

In carrying the work forward, the four air compressors are set off along the right-of-way at intervals of about 2,000 ft. and initially are located at the advance end of the 1,000-ft. lines which they supply with air. Connection between the compressors and the pipe lines is effected through an arrangement of short pipe sections, elbows and tees, provided with Barco flexible joints and globe valves. When a compressor and its air line have been set up, the surfacing gang begins operations at the far end of the line, utilizing the first two take-offs. Each of these take-offs serves a group of six tamping tools, which are connected to it through a manifold pipe and a short section of air-brake hose, fitted with a coupler head. As the work progresses and each successive 60-ft. length of track is given its final surface, the air cock is closed in the take-off, and by breaking the take-off line at the air-brake hose coupling each group of six tampers can be moved forward and coupled in to the main pipe line at another point.

As the two gangs progress, leaving the far end of the main pipe line out of service, this part of the line is broken at the air-brake hose couplings provided, and the 60-ft. lengths released are pulled forward and connected to form a continuous 1,000-ft. line in advance of the compressor. Through this arrangement the tamping gangs are permitted to operate continuously over 2,000 ft. of track without delay other than that necessary in moving their tamping tools ahead as each successive 60-ft. length of track is surfaced.

While four 12-tamper outfits are employed in each main division of the ballasting work, there are only three units in constant operation, this being due to the necessity of moving the compressors and their pipe lines forward as the work progresses. In each instance it is always the rear compressor which is moved, this change being made while the other three outfits are at work. In this manner there is always a complete tamping set-up at the head end of the work, ready for the use of the tamping gang which first completes the section on which it is working.

In advancing a compressor to a new location a small force of men moves the compressor forward under its own power and sets it off about 2,000 ft.



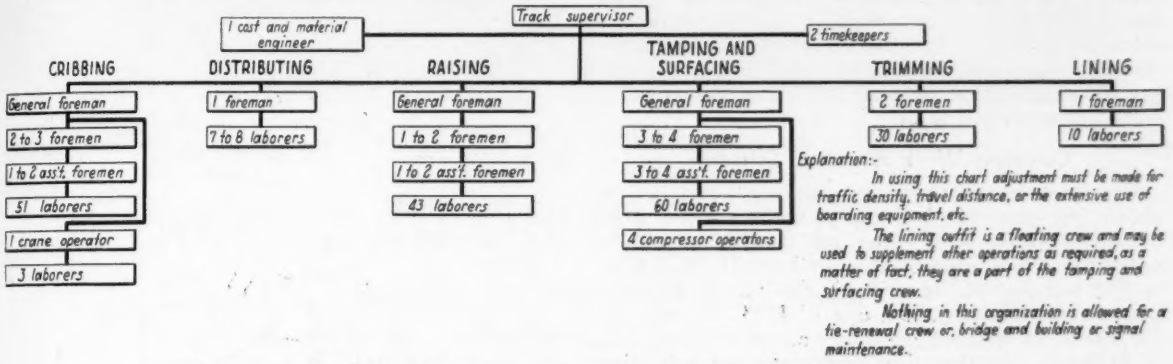

**Piping Diagram for Pneumatic Tampers**

ahead of the first compressor. This same force then breaks up the pipe line at the air-brake couplings and moves the entire group of 60-ft. lengths forward on two push cars. At the new location the line is again built up in the rear of the compressor, ready for tamping operations.

The surfacing gangs are followed closely, first by a lining crew, which irons out any minor irregularities which may have developed during the surfacing work, and then by a dressing and trimming crew, which dresses up the ballast and provides a neat toe line.

### Careful Attention to Labor Organization

The entire rock ballasting organization during the present season consists of two separate groups. Each




**Ballasting Organization Designed to Complete 2,000 Ft. of Single Track per Day**

of these groups has been carefully built up on the basis of securing 2,000 ft. of completely ballasted and surfaced single track per day, the number of men employed in each phase of the work being based on the extended performance during the ballasting work of 1927. As shown in the accompanying chart, this basic organization is divided into six distinct gangs; a cribbing gang, a distributing gang, a raising gang, a tamping and surfacing gang, a trimming gang and a lining gang. As noted, each of these gangs is under the direct supervision of a general foreman or a foreman, and the work as a whole is under the constant supervision of a track supervisor. The complete force includes the track supervisor, a cost engineer assigned from the division office, 2 timekeepers, 3 general foremen, from 10 to 13 foremen, from 5 to 8 assistant foremen, 1 crane or ditcher operator, 4 compressor operators, and about 205 laborers. This large organization is adjusted from time to time to take into account such factors as traffic density and the travel-distance of the men. The raising crew is built up around a large extra gang, which is moved along with the work and housed in camp-car equipment. The filling out of the organization to the full strength required through any particular territory is done by calling upon the regular track forces.

It is to be noted from the accompanying organization chart that no provision is made for the renewal of ties during the track ballasting work, in spite of the fact that these two operations are carried out simultaneously. Reference to this widely varying auxiliary phase of the work has been omitted purposely so as to take from the ballasting operations any factor which would prevent the formation of accurate records on the actual ballasting operations for comparative purposes. For the same reason all reference to tie renewals is omitted from progress, cost and material records kept in connection with the ballasting program, all details relative to tie renewals being kept under control through a separate set of records.

### Program and Records Stimulate Efficiency

With the carefully designed ballasting organization employed on the Boston & Maine, and the effective use being made of power equipment, well over 2,000 ft. of single track is being completed each day by each of the two ballasting gangs. This record, which represents a substantial improvement over the output secured in 1927, has been brought about mainly through refinements in the labor organization, which, in turn, have resulted in improved performance in each phase of the work. This improvement is shown in the following table, which gives the average output per laborer per day in 1927 as compared with the record thus far in 1928.

| Operation | Single Track 1927 | 1928 |
|---|---|---|
| Cribbing | 39 ft. | 43 ft. |
| Distributing | 275 ft. | 322 ft. |
| Raising | 48 ft. | 52 ft. |
| Tamping and surfacing | 36 ft. | 38 ft. |
| Trimming | 67 ft. | 75 ft. |

As a result of this increased performance, up to the first of July of this year an average of only 0.9 man-hours was required for completely ballasting a foot of single track, whereas an average of 1.02 man-hours was required for this same work throughout the season of 1927.

### Better Performance This Year

The improved performance in the ballasting work this year, as compared with 1926, is clearly indicated by the fact that, whereas the average cost of the work per foot of single track in 1926, including all labor operations, all material and transportation costs, and the use of equipment and work trains, was $1.45, the average cost, on this same basis, until July 1 of this year, was only $1.15. If this large reduction in cost is maintained throughout the 113½-mile program for 1928, it will have resulted in an actual saving over 1926 of approximately $180,000.

As practically the same arrangement of power equipment in connection with the ballasting work is being used this year as was used in 1927, major credit for the improved efficiency is given to two things: refinement in the labor organization and the careful record and check maintained on each operation. Of the two, the larger part of the credit is given to the practice of maintaining a careful check on the work, for, in large measure, it has been through

this check that improvements have been brought about in the ballasting organization.

In keeping this close check, the first step involves a carefully prepared program covering the work on each of the main districts on which ballasting is to be carried out. This program is set down in chart form, as shown in the accompanying illustration, and is divided into seven-day periods throughout the ballasting season. Opposite the date concluding each of the seven-day periods is indicated the number of feet of track which must be ballasted, and the percentage of the program which must be completed at that time in order to keep up with the program schedule. Similarly, the allowable expenditure up to and including each period is also indicated opposite each date. With this method of laying out the ballast program in simple chart form, it is possible to plot directly on the program chart, the actual amount of work accomplished and the actual cost of the work, thereby obtaining an accurate and easily comprehended relationship between the program and the work accomplished to date.

### Complete Work Ahead of Schedule

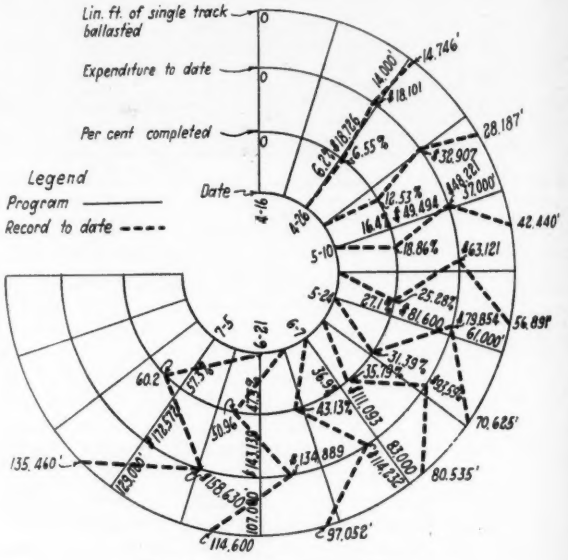
By reference to the accompanying chart, which shows the program and the progress of the work between Winter Hill, Mass., and Lowell, it will be noted the schedule shows that, by June 21, 107,000 ft., or 47.5 per cent of the work on this territory should have been completed, at a cost of $143,139, whereas, 135,460 ft., or 60.2 per cent, was completed, at a cost of $158,630. At that time, therefore, the ballasting work between Winter Hill and Lowell was approximately 16 days ahead of schedule, and about $22,000 under the estimated expenditure.

The careful records of the progress of the work are maintained up to date through the cost engineer and timekeepers who are assigned to work with each

**Unloading Crushed Stone from Hopper Cars**

of the ballasting gangs, and through a simple, but effective, system of reports which are kept constantly up to date. The basis of these reports is the record secured daily by the cost engineer, whose principal duties are to keep track of the progress being made, and of all materials used. Each morning he provides the office of the engineer maintenance of way with a telegraphic report of the work accomplished, and follows this with a detailed form report. This latter report shows the progress made daily in each phase of the work, and includes such other items as the quantity of ballast unloaded, size of force, number of ties renewed, and labor and material costs.

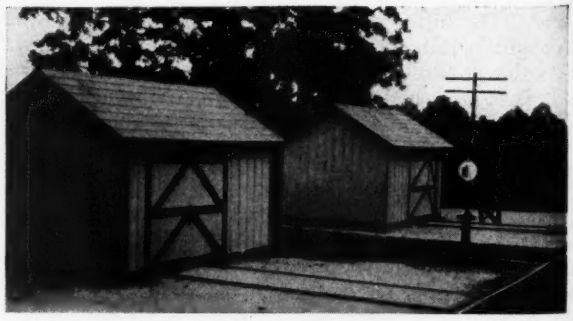
The labor cost data included in these reports are furnished to the cost engineer by the timekeepers, in the form of a detailed cost statement. For each distinct operation of the work, this statement shows the number of men employed, the hours worked, the rate of pay for each class of employees, the total labor cost, the travel-time of the men, the cost of the travel-time, and the total cost for the day. Other important



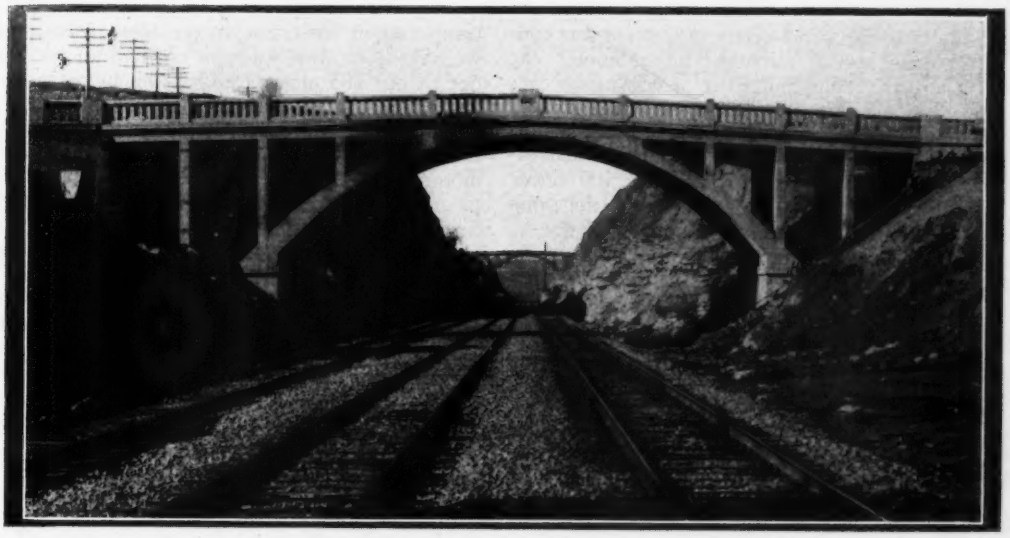

**The Program-Progress Chart**

records kept in connection with the ballasting program include a weekly report showing progress and costs for the week, and cumulative to date; a chart on which the progress of the separate operations is plotted daily or weekly by survey stations; and a tabulated report showing the cumulative average costs of various operations per foot, for labor, material, freight, work train service and equipment.

Through these detailed reports and records, the office of the engineer maintenance of way and the supervisory forces in charge of the work are kept informed constantly as to the progress being made and the amount of money which is being expended. This enables them not only to keep a close check on the efficiency of performance, but also gives them a basis from which to work out and maintain the most effective organization.



**Two Well-Kept Toolhouses**



*The Gilmore Arch on the Delaware Lackawanna & Western*

# Putting It Up to the Foreman*

## D. L. & W. Has Reduced Accidents by Transferring Initative for Safety Work to Foremen's Supervisory Organization

By R. ROWLAND

**Section Foreman, Delaware, Lackawanna & Western**

IN AUGUST, 1922, working condtions on the Delaware, Lackawanna & Western were not satisfactory to the section and extra gang foremen, and it was arranged that a committee composed of two foremen from each of the nine maintenance of way divisions, together with the roadmaster from each division, should consult with A. J. Neafie, principal assistant engineer, in charge of the maintenance of way department. A number of meetings were held and these resulted in the formation of the D. L. & W. Track Foremen's Supervisory Organization, of which every foreman in the maintenance of way department is a member. A general council of this body, composed of two foremen from each division, meets every three months to discuss circulars, bulletins, new tools or equipment, changes of standards and other matters with which the foremen must deal. The results of these meetings are presented at subsequent divisional meetings in order to give each foreman detailed information concerning any changes in methods or standards.

An organization of this kind was new to our members. At first, they were backward in offering suggestions and entering into discussions, but eventually this condition was overcome and the members became unusually active. We had heard and discussed Safety First before our organization was formed, but in the latter part of 1924, we began taking up Safety First questions systematically and it resulted quickly in our entire membership taking a deep interest in the safety movement. From that time on, our foremen have been working consistently along these lines. The management furnishes the members of the general council with a weekly blueprint report of accidents in the roadway department, showing the accidents by divisions, describing each accident in detail, and giving the name of the foreman under whom the injured employee was working.

### Safety Committee Formed

In 1925, we appointed three members of the general council to act as a Safety First committee, with instructions to meet several days in advance of the regular quarterly meeting, to study and classify for the consideration of the general council all accidents in the roadway department for the quarter preceding the meeting. The general council then goes over each accident with the Safety committee. When the division council meets with the foremen of their division, the accidents of that division are discussed. Each accident is considered separately, the foreman is shown where he was at fault, what he should have done under the circumstances, and how to prevent similar accidents in the future. We do not abuse and criticize a foreman severely for accidents, and this has resulted in the foreman not resenting our handling their accident cases with them.

The management furnishes a division safety emblem for the best record in the prevention of accidents. This is displayed on the first prize section of the division for three months and is then placed for the next three months on the second prize section of the division. The sign was awarded my division in 1926 and again in 1927. In both years, we averaged one accident for a little over 47,000 man-hours, on the basis of both major and minor accidents.

In our meetings we soon learned that the handling of motor cars was quite a problem from different angles

*Abstracted from a paper presented at the eighth annual meeting of the Safety Section of the American Railway Association, at Buffalo, N. Y., on May 16.

and especially in so far as the safety movement was concerned. We paid special attention to the motor car question. There are 285 maintenance of way motor cars on the 266 sections of the Lackawanna. We handle much of our maintenance material by the use of trailers and motor cars instead of work trains, which increases accident hazards. In 1927 we had 100 fewer work trains than in 1926, with approximately the same man-hours, and this work train reduction was due to the use of motor cars and trailers. Our study soon showed that the motor cars of the system were well maintained, being sent to the shops at least once a year for general overhauling. In studying the accidents, we found that most of them were due to the method of performing the work, and it was this particular feature that we made special efforts to correct.

Motor cars must pull trailers and not push them, except on rare occasions, and then only under the immediate supervision of the foreman in charge. Excessive speed of motor cars is forbidden. I do not know of a single case where any of our 285 motor cars were derailed by fast running, and we feel that this is largely on account of our motor cars being well maintained, closely inspected by the foreman, and operated at safe speeds. The placing of tools and materials on both the trailer and push car is carefully considered, and while the cars are in motion we have the men watching so that none will fall off and cause an accident.

### Precautions at Highway Crossings

Our most serious motor car problem was in connection with automobile drivers and highway crossings. In the few accidents we have had involving motor cars and automobiles at highway crossings, investigation showed the driver of the automobile to be at fault, but regardless of who was at fault, we now require a full stop before passing over highway grade crossings with a motor car. This order to come to a full stop at such places has been in effect since September, 1927, and since that time we have not had a highway crossing accident involving motor cars.

A foreman has in mind two kinds of crossings, a safe crossing and an unsafe crossing. The peculiar thing about accidents at highway crossings is that they generally happen on the foreman's mentally safe crossing. They usually approach these mentally safe crossings at a higher rate of speed, and with less alertness than they do the actually unsafe crossing. If a man is going into a cut on a heavy curve, with a crossing in that cut, he has his car under immediate control and he is alert for an obstruction of some kind on the crossing. Our method of stopping before proceeding over a highway crossing has eliminated this mentally safe crossing. Another kind of crossing may be safe to the foreman because of its being used only once or twice a day by the travelling public. This is naturally a mentally safe crossing to the foreman, but a really dangerous one to life and limb. Our motor cars are operated only by qualified men, and by qualified men, I mean section, extra-gang and student foremen.

There are two other serious problems that should be handled carefully in connection with motor cars; first, motor cars being hit by trains or engines, and, second, motor cars colliding with each other. To avoid being hit by trains or engines we endeavor to find out from the dispatcher the location of any such movements before placing our motor cars on the track. If we cannot get this information we protect ourselves by the use of flagmen, torpedoes, or fusees, and in some instances, by combinations of them. We decided in our organization that we would not take any chances of being caught by trains, regardless of cost, and since we have done this, we have not had an accident where one of our 285 motor cars was hit by a train. Several years ago, one of our foremen had his motor car hit. The men had sufficient time to get out of the way and there were no personal injuries, fortunately, but the motor car was badly damaged. We started our campaign with this case and believe that results since that time have justified our action.

The question of motor cars colliding with each other was also handled and we are surprisingly free from accidents in this respect. When a motor car is following another, it must stay back a specified distance, and the man on the leading car must not stop without signaling the man on the following car and having his signal acknowledged. If the leading car's signal is not acknowledged, he must not stop until it is acknowledged. This does not offer any difficulty as all our cars are equipped with Klaxon horns and it is an easy matter for one foreman to attract the attention of another by the use of the horn. The Klaxon horn is of material assistance to us as a warning device. I might also state that each foreman carries as his standard equipment one Acme Thunder whistle.

### Motor Cars Are Maintained Carefully

Motor car accidents on the Lackawanna are reduced materially by the arrangement for taking care of these cars. The railroad is divided into two divisions, and there is a mechanical supervisor on each division, with motor mechanics under his supervision whose duties are to travel over the road, inspect motor cars, make minor repairs in the field, and keep them in safe working condition. The foreman has the necessary authority to take up immediately with the mechanical supervisor and his forces any unsafe conditions on their cars.

Frequently trailers are used with motor cars to carry men. No man is allowed to sit on either the front or rear of the trailer, nor are they allowed to sit so that their limbs will be between the motor car and trailer. All employees must be seated when the cars are started and must remain seated until the cars are stopped. This rule has been in effect a long time and we have had no injuries by men being thrown when the car was started. We have had a few cases in which laborers stood up before the car came to a standstill and were thrown, resulting in slight injury, but we have had no serious injuries in this respect. Motor cars are equipped with safety foot boards and hand rails. We have a detachable seat equipped with a hand rail which is used on the trailers when they are used for transporting men.

To encourage our foremen in avoiding accidents with their motor cars, we have a circular safety medal which is secured to the front of the motor car by two brass screws in case the motor car has not been in an accident for one year. The medal reads: "No Accidents During the Past Year—Safety First—This Was Accomplished by a Careful Man." If a foreman has an accident with his motor car this medal is taken away from him for one year. All but one of our 285 motor cars have these medals, and it is surprising how a foreman hates to have his medal taken off his car.

In case of serious accidents involving employees of our department, I make an investigation, together with the chairman of the Safety First committee of our organization, at the point of the accident. This has a material advantage in that it gives us detailed knowledge of the accident, and places us in a position to get the facts clearly before our members.

In 1921, all departments on the railroad had 138

motor cars. We now have 285, or an increase of 105 per cent. In 1921, we had 26 major and minor injuries in connection with motor cars, and in 1927 we had 37 injuries, or an increase of 42 per cent. You will, therefore, note that in six years the number of motor cars increased 105 per cent and motor car accident, both major and minor, increased only 42 per cent, which is a marked improvement. I also wish to call your attention to the fact that of the 26 accidents in 1921, two were fatal, whereas in 1927, only one was fatal. From 1921 to 1927, inclusive, or a period of seven years, the total accidents on the Lackawanna in all departments in connection with motor cars was five employees killed, 57 lost more than three days pay, and 159 others had minor injuries; a total of 221 accidents, or less than 32 accidents per year.

In June, 1926, the principal assistant engineer instructed the vice-president of our organization to travel with me over the system in the interest of safety in the roadway department. During this trip we visited every section and extra-gang while they were actually at work in the field, inspected their motor cars, tools, equipment, method of doing the work and then addressed the men in the gang on working safely. The roadmaster or the supervisor of the division accompanied us over his division. We stopped at highway crossings where gatemen or flagmen were on duty, inspected the crossing and discussed safety with them. The month preceding our trip, major injuries were 0.2 per 10,000 man-hours. The following month there was a sharp reduction in injuries, and in the month of August we had only one major injury among 4,000 men. In the following November there were no injuries.

We developed that one of the principal unsafe conditions we have to contend with is the employment of workmen recruited from floating labor, and breaking in green men. We have found that these men frequently do the wrong thing, which results in an injury to an experienced man, and that whenever they are employed our accidents have always increased sharply.

### Good Tools and Good Housekeeping

The majority of our foremen have had long years of experience in track work. A record of the nineteen men making up the general council of our organization shows that the average service of the foreman in track work is 25½ years and his average service as a foreman is over 20 years. Our organization stresses the importance of every foreman seeing that his tools are in proper working condition.

We are furnished goggles by the company to be used when cutting rail, operating grinding outfits and other work endangering the eye, and are supplied with first-aid kits as a part of our standard equipment, which we must keep with us on the job at all times.

Our management insists on good housekeeping, and we think this is very important in keeping down accidents to employees of all departments. Scrap, drawbars, etc., are picked up promptly and moved where they will not cause personal injuries. Standardization is an important help to us in our safety work. We have standard lining bars, track gages, adzes, section motor cars, carbide lamps, etc. This standardization is helpful in that when a foreman from one point on the road talks about the difficulty he has with a certain tool, motor car or lamp, all the rest of the foremen know what he is talking about as his motor car or tools are the same.

We have had many discussions concerning men being struck by trains. It is our rule that when a train approaches a gang of men, foreman and all must clear all tracks excepting, of course, in yards. We have another rule that where large gangs of men are performing work, one man on double track, or two men on single track are placed in a lookout position to warn the men of approaching trains. We have another rule that if, on double track, trains are running against the current of traffic, a lookout man is immediately placed on either side of the gang and is held there until we have knowledge that traffic has been regularly restored, when one of the men is called back to the gang. There is another rule that when men are working on curves or in locations where the view is obstructed, a man is placed in a lookout position, regardless of how many men are in the gang. If a gang is split up into small gangs for any reason, and a foreman or student foreman cannot be placed in charge of the men, one of the men in the gang is given charge of the work. The proper clearing of trains is something that must be drilled into the foremen, since the failure to do so is a habit handed down to us by our forefathers. In the days prior to accident prevention work, it was a common occurrence for supervising officers to compliment the foremen and their men on the promptness with which they got back on the track after the train had passed. The closer the man stood to the track when trains were passing, the quicker he could get back to work.

January of this year showed an improvement of 19 per cent over January of last year on the basis of injuries per man-hours. February of this year showed an improvement of 30 per cent over February of last year. March of this year showed an improvement of 40 per cent over March of last year, while April showed a very much greater improvement over the same month last year.

We are encouraged in the headway we have made in reducing accidents in our department and are very much interested in keeping the question of working safely before all our men at all times.

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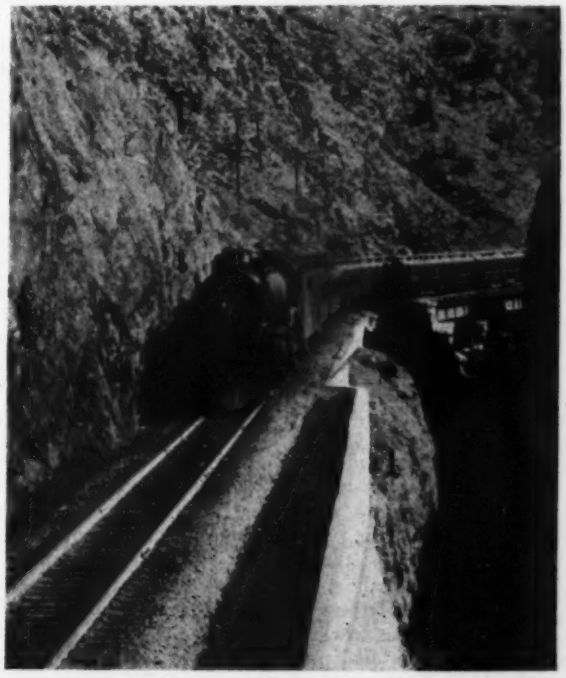


**In the Apache Canyon, New Mexico, on the Santa Fe**

# Derailment Caused by "Buckled" Track

THE derailment of a mixed train carrying circus equipment on the Grand Trunk Western, near Flushing, Mich., on July 8, was attributed to the buckling of the track under the rear portion of the train, according to a report of the Bureau of Safety of the Interstate Commerce Commission after an investigation of the accident, which resulted in the injury of 16 circus

In the vicinity of the accident, according to this report, the track is composed of 60-lb. rail, 30 ft. long, laid in 1888, with an average of about 18 softwood ties to the rail length. The ties were single spiked and supported on about eight inches of gravel and cinder ballast. No tie plates or rail anchors were used.

The train involved consisted of 5 stock cars, 23 flat cars, 7 coaches and a caboose, in the order named, hauled by two locomotives. The train, whose speed was restricted by train order to 20 miles an hour, was traveling at an estimated speed of from 12 to 15 miles an hour when the accident occurred. The rear truck of the second coach and the third to the sixth coaches, inclusive, were derailed, the rear end of the second coach, the third coach and the forward end of the fourth coach coming to rest at the bottom of an eight-foot fill.

According to the testimony at the investigation, an examination of the track by the train and engine crews immediately after the accident showed that the track had buckled out of line at the point of derailment and that there was no evidence of a derailment or of dragging equipment back of the point where the track was buckled. An inspection of the derailed equipment disclosed no defects which would cause a derailment.

The supervisor of track and the section foreman testified that the track had buckled out of line between sixteen and seventeen inches for a distance of about thirty feet, where the derailment occurred. The section foreman thought this was caused by the excessive heat, although it might have been contributed to by a weak spot in the track, these suppositions being based on the fact that about a week previous to the date of accident, a section of rail was removed from the track, which was found buckled out of line at a point about ten rail lengths north of the point of the accident, together with the fact that several rail joints were raised in the vicinity of the point of accident on the day prior to its occurrence. He also said he had noted rails creeping quite frequently on his section. The supervisor said that trouble had been experienced by rails creeping in that vicinity for the last three years, or since larger engines had been put into use, but his only knowledge of the track buckling during that time was on two former occasions, the last time being about ten days prior to the accident. As there were no tie plates or rail anchors, the only thing that could be done to remedy this condition was to tighten the bolts and spikes.

The finding of the Bureauy of Safety was that "this accident was caused by the track buckling under the train, due to excessive heat and the poor condition of the track." It also stated that "the evidence also indicated that heavier types of engines had recently been put into use in the territory in which the accident occurred and, according to the statements of Supervisor Dodge, the use of these heavier engines causes the rails to creep and the track to buckle to a greater extent. These conditions will prevail until the track is put into such shape as to enable it to support the engines now being used."

**BUFFALO, ROCHESTER AND PITTSBURGH RAILWAY COMPANY**

**ENGINEERING DEPARTMENT**

**PUTTING THE PROPERTY BY FOR THE WINTER**

**BULLETIN NO 7**

**Always Keep Drainage in Mind**

At this time when the season's work is being brought to a close we must, as in former years, give our attention to details of maintenance peculiar to this season of the year and discontinue out-of-face maintenance work, such as raising track by section forces, and devote our attention to the work of putting the property in first-class condition to go through the winter This work has already been programmed by letter and is referred to in considerable detail in Bulletin No. 3, dated October 15, 1927 which should be carefully read over at this time

The object of this particular program is to do whatever work is necessary to complete the season's reconditioning of the property and insure all details being brought up to a uniform basis of maintenance. Therefore, particular attention should be given to those details which have not been thoroughly gone over and put in first-class condition during the season's work **Thoroughness and uniformity should be the guide.**

Before signal mechanisms are closed and sealed for the winter our aim to have every mechanism carefully tested and inspected by the Signal Inspectors can and should be accomplished without undue haste on the part of the Inspector **A job worth doing is worth doing well.**

In spotting up and lining main tracks out of face, don't pass up stretches of track which were raised this year, give them the same thorough attention as the rest of the track Nothing prolongs the good effect of raising track out of face more than a careful spotting up and lining of such track just before winter Watch for loose and hanging ties and get them all tamped up solid, carry the lining along close to the spotting up **Remember that good line and surface depend on each other.**

The details laid down in Bulletin No 3 to be followed by the Signal Maintainers in preparing signal mechanisms for sealing should be reviewed and it should be remembered that these mechanisms are closed and sealed for a purpose, and the aim should be to put them in such shape that there will be no necessity for opening before the specified time

Before winter, heating plants, including stoves, stove pipes and flues, must be put in good order and made not only efficient, but safe for use Exposed water lines in and around buildings should be properly protected and exposed lines which will not be used during the winter should be shut off and properly drained to prevent damage from freezing Water barrels on bridges should be drained and those in buildings not protected by heat should be properly salted to prevent freezing **In time of good weather, prepare for the bad; get winter facilities in good order before they are needed.**

While, in general, the trunking and wire renewal for the season is completed, there will still be some of this work in connection with new rail and track reballasting to be taken care of and it should be kept close up to the work of track forces so that no appreciable amount of this work will accumulate on any maintainer's section. The time in which we have to do this work may seem short, we should, however, continue our practice of renewal rather than repair of trunking and wiring where track has been raised and reballasted **Don't shirk the task of renewal for the easier course of repair.**

Clean up the property properly as the work of spotting and lining track proceeds, keeping in mind always the practical value of good appearance Do this work on a uniform basis and make every part of the property equally clean and neat Be sure to clean up around stations, shops and other buildings thoroughly Use the grass line marker and straighten the ballast line. Clean the subgrade and scour all ditches **Don't wait to be reminded of small details always required, but often overlooked.**

That part of Bulletin No 3 pertaining to the leveling, lining and freeing of pipe lines, the adjusting and draining of switches at interlocking plants, will always be an important subject at this time of year The operation of interlocking plants becomes more difficult with cold and stormy weather A careful out-of-face inspection should be made of each plant **Give attention to the little as well as the larger things.**

Drainage conditions require careful study and attention at this time Open inlets and outlets of culverts and other important waterways and put them in condition to do their work Watch out for bad drainage conditions at crossings, most of which can be corrected or at least improved with very little work. **Water in or near the roadbed is an enemy to track; turn it away.** Read again Bulletin No. 4, Drainage

Pole and wire lines are parts of our plant that are exposed to the storms of winter and should be put in shape to withstand these conditions. Known broken or weak poles should be replaced. Unreliable anchors on heavy corners should be renewed Loose and hanging ties replaced **Remember a pole line like a chain, is no stronger than its weakest link.**

The paragraph of Bulletin 3 dealing with running repairs to lighting in and around buildings, especially shops and engine houses, should be brought to the attention of the men in charge of this class of work.

At this time, look out for building conditions which might cause trouble in the winter, such as defective eaves troughs and down spouts, bad spots in roofs and flashings. Repair such places when repairs will suffice and renew out of face where necessary Light, inexpensive repairs made at this time may prevent bad conditions and heavy expense in the middle of the winter

During the remainder of the fall and early winter a greater amount of time can and should be spent in rebonding While substantial progress in this work was made during the early part of the summer, not much has been done in the last two or three months, and it should again be taken up and vigorously pursued with the idea of renewing all of our old bonding within the next year **Bonding must not only be good, but must look good.**

Sewers, catchbasins, sumps and drains, especially at terminals, should be inspected, cleaned and repaired as necessary Their heaviest work is done in the winter and they should, therefore, be started off clean and in good repair. **Repairs to concrete which are necessary at this time should be made strictly in accordance with instructions covering the mixing and placing of concrete, using pure water and clean materials and carefully protecting green concrete from freezing where necessary**

Be sure to have a sufficient supply of bolts, nut locks and rail anchors on hand and don't slight the work of bolt tightening, driving down spikes and adjusting rail anchors. **Haste makes waste. Do only each day what can be well done.**

If the various details of our usual fall program of cleaning up the property and putting it in uniformly good condition to withstand the strenuous winter requirements is carried out, we can avoid troublesome interference with important and constructive winter work and be thereby better enabled to carry out a vigorous program of winter ditching, fencing, cutting brush and clearing right of way and other constructive work which can be done to good advantage in the winter. **Be foresighted and prepare for the winter.**

**ALWAYS KEEP DRAINAGE IN MIND.**

E W HAMMOND.
Engineer Maintenance of Way

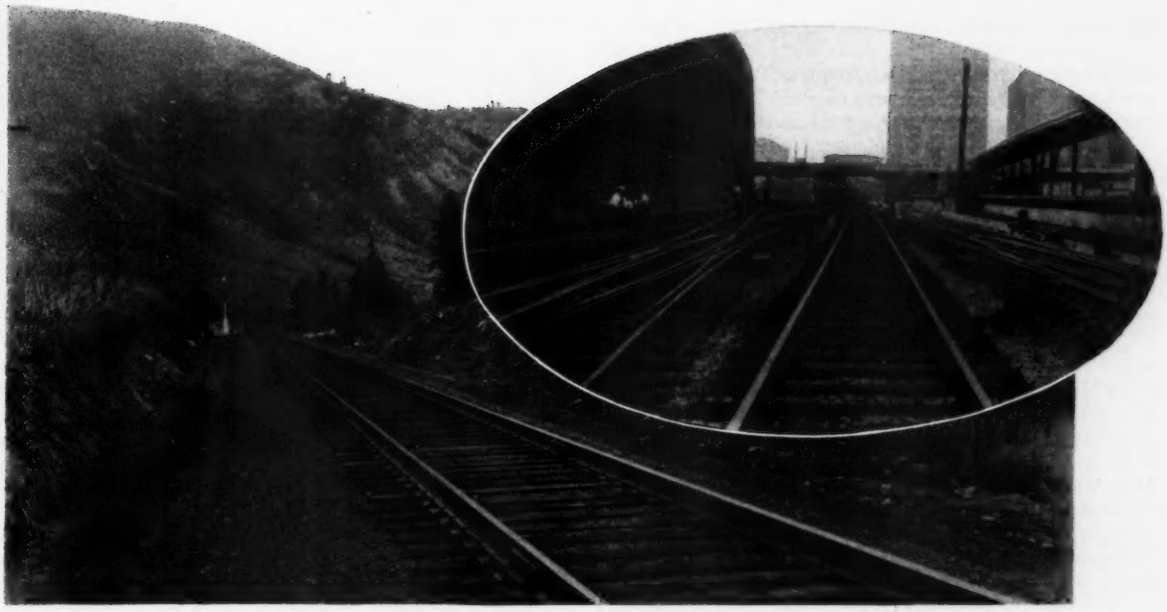
W L. CONNORS.
Signal Engineer

Approved

Rochester N Y.
October 15, 1928

E F ROBINSON.
Chief Engineer

**A Bulletin on Preparing for Winter**
**A timely bulletin sent to all maintenance foremen on the B. R. & P.**



*The amount of work necessary to maintain a mile of track varies with its character*

# How Long Is a Mile of Track?

## A Study of the Factors to Be Used in Equating Mileage for Maintenance of Way Operations

By J. M. SILLS*

IN PRESENTING this paper, it should be made clear at once that the writer has no intention of laying down arbitrary or hard and fast rules in connection with the method of equating which is described. It should be thoroughly understood that all that can be hoped for is a guide which will at once eliminate many errors that have occurred in the past in distributing money for maintenance work. It is not intended, in this discussion, to go into the feature of the present condition of the property, nor is it intended to equate in any way for such matters as climate, the condition of the roadbed itself, the kind of labor used, or any other such general condition. These things necessarily must be worked out according to the best judgment of the roadmaster and division engineer in charge of the territory, in the case of a single division, or by some other competent authority in the case of larger or smaller units. In the application of these equations, it is thought that the best thing on the subdivision and division is to try to equate the individual sections in such a way that they will be practically equal in length, in so far as the points covered by the following equations are concerned. The remaining factors, such as roadbed conditions, etc., can be taken care of by the number of men used on the individual section.

In the past, in trying to make definite comparisons, it has been found convenient to reduce certain units of property to the equivalent of miles of main track. This has been done by many individual engineers, and to some extent, by the American Railway Engineering Association. There has been, of course, a great difference of opinion as to just what could or should be equated. The values used also varied to a great extent on different properties where there was any attempt at equating at all. In the following, we have tried to select the best from what has been done in the past, and to add certain refinements and improvements which we have found have really resulted in better track conditions. This paper is written simply with the idea of stimulating others to further efforts so that the whole subject may be better understood and further improvements made in the practical application of such equations.

### Equated Mileage Affords True Perspective

Wherever the fixed characteristics are equated and money is distributed on the basis of fairly well-equated mileage, the most noticeable thing is that certain conditions on individual sections begin to come to light and are more readily understandable than they ever were before. It is then relatively easy to determine just what the conditions need. For example, if the trouble is bad roadbed, or drainage is needed, or there is an incompetent foreman—this very soon begins to show up quite clearly and the foreman can be educated; the drainage taken care of, or necessary changes made in the roadbed in order that the condition itself can be relieved, or at least improved. The following equations and ideas have been worked on for the past seven years, and the results obtained have been observed closely after the application of different formulas and methods of distribution, and while, as stated, it is realized that it is by no means perfect, yet a very noticeable im-

*Mr. Sills was division engineer on the St. Louis-San Francisco with headquarters at Springfield, Mo., until September 1, 1928.

provement in track conditions has resulted. During a large portion of this time, costs were kept as a guide, and, keeping in mind the relative condition of the property before and after the time covered by the costs, corrections were made in the factors and equations.

For example, two statements of equated miles were worked up. In the first, our own factors, as developed up to that time, were used. The main line classification factors were obtained from other railroads. A study of the net cost, on a 32 cents per-hour basis, per equated mile, indicated that terminals were equated somewhat too high and branch lines too low. In the second statement, factors were used as submitted as information in 1922, by the Committee on Economics of Railway Labor of the American Railway Engineering Association. The main-line classification factors used were the same as in the first statement. After studying the net cost per equivalent mile as before, it was found that terminals were now classified somewhat too low, while the branch lines were left practically as before.

Several compromise statements were then worked up, changing the factors in each, in an attempt to get a reasonable relation of costs per equivalent mile. It was found that this could not be wholly accomplished except by changing the main line classification and this brought again to our attention a fact that repeatedly had made itself felt—that our system of classification was not flexible enough.

### Three Sets of Factors Necessary

Throughout our study of equating characteristics of track maintenance, we have found it necessary to apply three primary sets of factors. The first set is concerned with the conversion of all maintenance work into units equivalent to the work required to maintain one mile of main line. The number of these units is directly proportional to the amount of property maintained. The second set of factors takes into consideration the increase in work as related to increase in traffic and speed, while the third set takes into consideration the general condition of the property. For instance, property that has been neglected may require extra work to be restored to normal. This factor must be determined by a competent supervisor thoroughly familiar with the conditions, as its accuracy is dependent entirely on his good judgment. In working up all previous statements, we had confined oursélves to the application of only the first two factors, because the third could not be applied by a definite formula.

We had given considerable thought to the first set of factors, but so far had made little progress on the second. Evidently an arbitrary classification into three classes, A, B, and C, leaves much to be desired. However, it is a step in the right direction if the classification is made on the basis of traffic.

### The Classification of Track

In 1919, the Committee on Economics of Railway Labor of the A.R.E.A. recommended the following classification:

Class "A"—Railways having more than one track, or a single track with the following traffic per mile:

Freight cars per year: 150,000 (or 5,000,000 tons).
Passenger cars per year: 10,000.
Maximum passenger speed of 50 miles per hour.

Class "B"—Single track lines having the following traffic per mile:

Freight cars per year: 50,000 (or 1,670,000 tons).
Passenger cars per year: 5,000.
Maximum passenger speed of 40 miles per hour.

Class "C"—Single track not meeting the requirements of Class "B."

This appears to be a good method of classifying track. However, to be applicable as a factor for equating mileage, it is necessary to determine a numerical relation. Further, this relation should not be confined to three fixed classifications, but should be on a sliding scale. We have attempted to work out such a scale, and, while we do not wish to submit it as final or perfect, we feel that it is a long step in the right direction.

In connection with the working out of track classification factors, we find it necessary to begin with a more or less arbitrary base figure to take care of maintenance of labor not affected by volume of traffic. This base we found to be 0.40. This covers such work as grassing track, cutting sod lines, mowing and burning right-of-way, dressing ballast shoulders, cleaning ditches, repairing culverts, fences, stock guards, crossings and signs, etc., as well as a portion of the tie insertions, track surfacing, rail laying, patroling track, etc. Factors are then built up as follows:

| | |
|---|---|
| Minimum not affected by volume of traffic | 0.40 |
| Per million gross ton-miles of freight per mile of main track per year | 0.03 |
| Per 5,000 car-miles of passenger equipment per mile of main track per year | 0.01 |
| Per 8 miles of maximum speed | 0.01 |

Assuming that a given stretch of track handles 10,000,000 gross ton-miles of freight per mile of main track per year, and 20,000 car-miles of passenger equipment per mile of main track per year, and is limited to a speed 60 miles per hour, the traffic factors would be as follows:

| | |
|---|---|
| Minimum not affected by volume of traffic | 0.40 |
| Freight traffic, 10,000,000 gross tons@.03 per million | 0.30 |
| Passenger traffic, 20,000 cars@.01 per 5 thousand | 0.04 |
| Speed, 60 miles per hour@.01 per 8 miles | 0.08 |
| Classification factor | 0.82 |

Making an assumption that a given stretch of track has 100 equated miles (equated for property) with traffic and speed as above, the final equated miles would be 100 times 0.82, or 82 equated miles.

The following values were found, as outlined above, by studying costs for various sections of track, both separately and grouped, and extending over a period of years.

One mile of first main track is equivalent to:
1.15 miles of second main track.
2.00 miles of passing tracks.
2.75 miles of terminal sidings.
3.33 miles of other sidings.
12 main track switches.
14 switches in terminal sidings.
20 other switches.
3 double slip switches.
6 single slip switches.
10 railroad crossings (steam or electric).
16 main track and city street crossings.
30 main track and public road crossings.
60 street or road and siding crossings.

These values will be seen to follow closely those suggested in the report by the Committee on Economics of Railway Labor of the American Railway Engineering Association in 1922 and repeated in the committee's report for 1928.

### Curvature Must Be Considered

After equating for the individual sections by applying property factors and traffic factors, as above, marked inconsistencies were noticed. These were soon traced to the effect of curvature. Although we had equated for curvature, it had been on the basis of miles of curvature, without regard to the sharpness of the curves. In most cases, the effect was fairly well balanced, since each section had both light and heavy curves. We had, however, a few sections with extremely long and sharp

curves, and it was evident, almost at once, that our equations were unfair to these.

Fortunately, we had accumulated cost data for several of these sections, and, with these costs as a guide, we worked out an equation which took into account sharpness as well as length of curvature. Reduced to its simplest form, it is as follows: Additional main track mileage on account of curvature equals one mile per 200 deg. of total change of direction. For example, assume that a section has five miles of main track with the following curves:

| | |
|---|---|
| 2,000 ft. of 1 deg. curve, total central angle | 20 deg. |
| 3,000 ft. of 2 deg. curve, total central angle | 60 deg. |
| 2,500 ft. of 4 deg. curve, total central angle | 100 deg. |
| Total change of direction | 180 deg. |

The additional main track mileage chargeable to curvature in this case is 180 divided by 200, or 0.90 miles.

The advantage of having the formula in terms of degrees of central angle is that spirals and compound curves do not complicate the computation. Expressed in terms of length and degree of curvature the formula becomes: Additional main track mileage on account of curvature equals 0.264 mile per mile of curve per degree of curve.

The accompanying statement of equivalent mileage is set up in the form we have found convenient.

**Equated Miles by Sections, Second Operating Division**

(Sections 14 to 20, inclusive, not shown)

| | Factors | | Section 13 | | Total for Sections 13 to 29 incl. | |
|---|---|---|---|---|---|---|
| | Property and Curves | Traffic and Speed | Quantity | Equated Miles | Quantity | Equated Miles |
| First main track, miles | 1.00 | .757 | 4.38 | 3.32 | 84.70 | 64.12 |
| Second main track, miles | .869 | .454 | 0.11 | .04 | 0.11 | .04 |
| Passing tracks, miles | .500 | .757 | 0.75 | .28 | 17.25 | 6.54 |
| Terminal sidings, miles | .364 | .608 | None | ..... | None | ..... |
| Other sidings, miles | .300 | .608 | 1.99 | .36 | 7.61 | 1.39 |
| Main track switches | .083 | .757 | 9 | .57 | 73 | 4.59 |
| Terminal siding switches | .071 | .608 | None | ..... | None | ..... |
| Other switches | .500 | .608 | 9 | .27 | 41 | 1.25 |
| Double slip switches | .333 | 1.000 | None | ..... | None | ..... |
| Single slip switches | .167 | 1.000 | None | ..... | None | ..... |
| Railroad crossings | .100 | 1.000 | None | ..... | None | ..... |
| Main track and street crossings | .067 | 1.000 | 4 | .27 | 34 | 2.28 |
| Main track and road crossings | .033 | 1.000 | 1 | .03 | 56 | 1.85 |
| Siding and road or street crossings | .017 | 1.000 | 12 | .20 | 68 | 1.16 |
| Extra main track account of curves, miles | 1.000 | .757 | 0.57 | .43 | 20.50 | 15.52 |
| Total equated miles | ..... | ..... | ..... | 5.77 | ..... | 98.74 |

Annual freight traffic: 6.92 million gross tons, average, over each mile of main track.
Annual passenger traffic: 37,000 cars, average, over each mile of main track.
Speed: Limited to 60 miles per hour.

The equated miles are the product of property factor × traffic factor × quantity.

In arriving at traffic factors, the following property is considered as being affected by freight traffic, passenger traffic and maximum speed: Main tracks; main track curves; passing tracks, and main track switches.

The following are considered affected by freight traffic, but not by passenger traffic and maximum speed: Terminal sidings; line sidings and industry tracks (excluding passing tracks), and switches in sidings.

The following property is affected by two-way traffic: (since actual traffic crossing the railroad cannot be readily determined, the traffic factor is assumed to be 1.00) double and single slip switches, railroad crossings, and city street and other public road crossings.

For double track, it may sometimes be convenient to proceed as follows: The traffic factor is first computed for the first main track as if it were single track, on the basis of total traffic. The resulting error is then compensated by finding the second-track factor as follows:

Let A equal traffic factor for single track.
Let B equal property factor for second main track.
Let R equal ½ of portion of traffic factor found account freight tonnage and passenger cars.
Let F equal the required compensated traffic factor for second main track.

$$\text{Then } F = A - R - \frac{R}{B}$$

In the above statement, the compensated traffic factor for second track was found as follows:

$$R = \tfrac{1}{2}\,(6.92 \times 0.03) + (37 \times .002) = 0.141$$

$$F = 0.757 - 0.141 - \frac{0.141}{0.869} = 0.454$$

This formula is based on the assumption that one-half of the total traffic is handled on each track, which should be sufficiently near the truth to serve all practical purposes. For double track where the two tracks are some distance apart, or do not occupy a common right-of-way, each track should be treated as single track on the basis of the traffic actually passing over it.

The use of the above data on a western railroad has resulted, as a whole, in obtaining a very much improved general distribution of the maintenance money; glaring errors in judgment were exposed by the use of these figures, and corrections have resulted in a more even maintenance over the entire property. In the application of the same figures to an individual division on this railroad, a marked general improvement in maintenance has resulted, and, in some cases, the reputation of individual section foremen has improved, while that of others is held only with harder work and closer application. In other words, inequalities of all sorts have been ironed out, and a very much better general condition exists, owing directly to the application of the above figures. The problem is fairly new, and the results possible to obtain are well worthy of much effort. It is the hope of the writer that many experiments will be made on various railroads and that the best obtainable formulas for the use on that property will be found, so that all the efficiency obtainable by proper distribution of the maintenance money will be reached.

The writer wishes to thank Mr. Frank L. Peters for his invaluable aid in the carrying out of the experiments made in connection with the method of equating as described.

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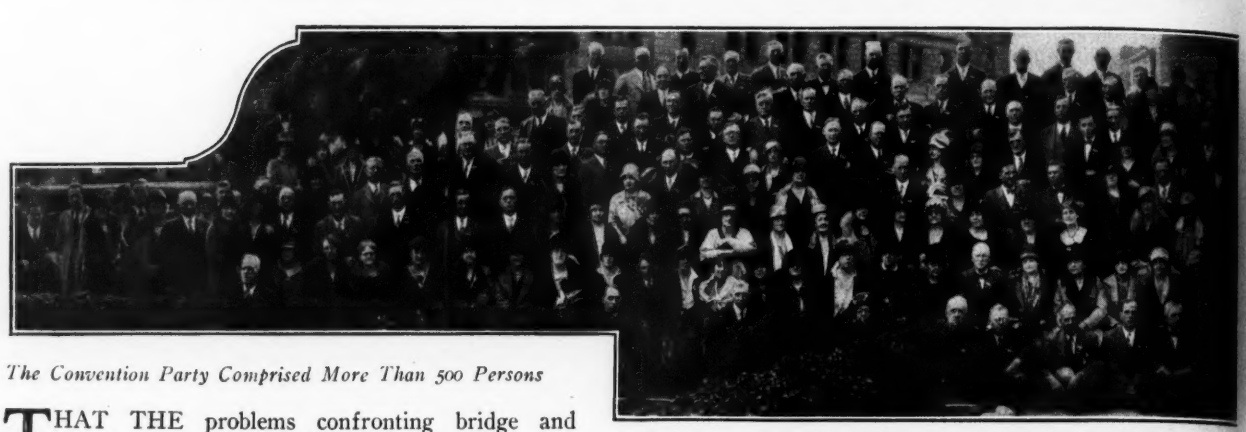
A Good Record.—Twenty-five months of highly exacting work without a single error is the record that was recently hung up by Willie Brock, a negro stowman employed by the Illinois Central at Jackson, Miss. Brock's duty is to load package freight in freight cars. Every day he handles several hundred packages, which he has to place properly in six cars, and he has not loaded a package incorrectly since June, 1926.

# When Bridge and Building



*The Convention Party Comprised More Than 500 Persons*

## A Report of the Thirty-Eighth on October 23-25 at of Problems

THAT THE problems confronting bridge and building men are as varied as they are important was evidenced by the program for the 38th annual convention of the American Railway Bridge and Building Association, which was held at Boston, Mass., on October 23-25. More than 210 members were present, forming, with the members of their families and of the supply men's organization, a group of more than 500 persons. Over 250 came from the West on a special train provided by the Canadian National, the Central Vermont and the Boston & Maine, which was operated via Montreal to give the members an opportunity to observe the unusual reconstruction problem thrust on the Central Vermont and other New England railways by the severe flood of last fall. Supplementing this trip a special session was held on Tuesday evening at which W. J. Backes, chief engineer, Boston & Maine, and C. E. Donaldson, supervisor of bridges and buildings, Central Vermont, described the manner in which the flood struck their respective lines, the damage it caused and the manner in which the various lines were restored to service. Their addresses were illustrated by lantern slides and by moving pictures.

In keeping with the long-established record of this association for constructive work, eight reports were presented by committees on subjects of direct concern to bridge and building supervisory officers. These reports were supplemented by two papers, one on The Wrecking and Salvaging of Railway Buildings by W. T. Krausch, engineer of buildings, C. B. & Q., and the other describing the Southern Pacific's proposed bridge across Suisun Bay near Oakland, Cal., and the foundation exploratory work made therefor, by H. I. Benjamin, assistant engineer of bridges, S. P. An abstract of the latter paper will appear in a later issue. These reports and papers were of a highly practical character and gave rise to active discussion. All sessions were presided over by F. C. Baluss (office engineer, Duluth, Missabe and Northern), president.

On Thursday afternoon the members were conducted through the new North Station of the B. & M., now under construction, by Mr. Backes, F. C. Shepherd, consulting engineer and members of their staffs.

### Association Given Hearty Welcome

The convention received a hearty welcome to Boston by George Hannauer, president of the Boston & Maine, who recalled that it was 22 years since the association last held a convention in that city. He referred at length to the background of New England and the extensive changes which have taken place in this interval and outlined in an interesting manner the difficulties of early railway builders in that part of the country. He then told of the unprecedented flood in New England during 1927, and of the extensive problem which confronted the men of the bridge and building department in the work of rehabilitating the lines. He pointed to the many responsibilities of the bridge and building forces and paid tribute to them for the way in which they have always responded with untiring efforts and resourcefulness in meeting emergencies.

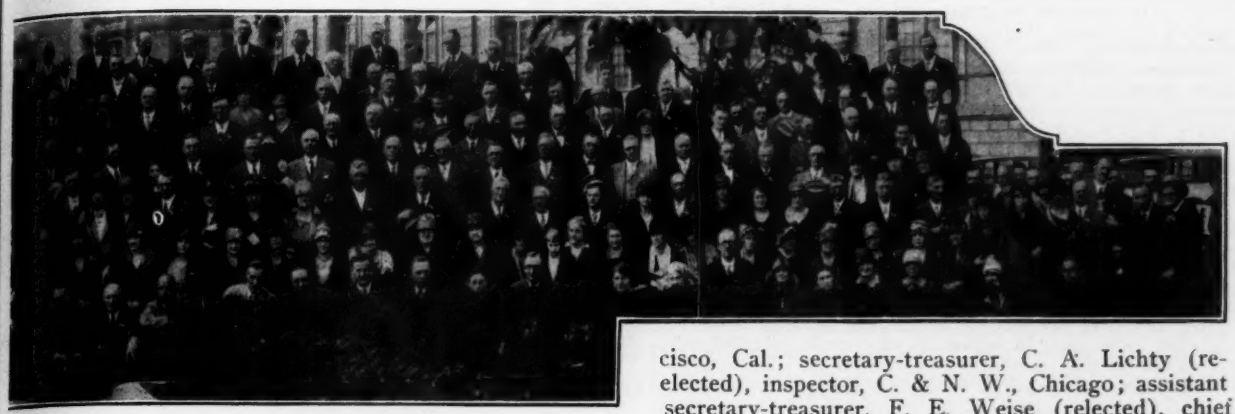
The welcome of Mr. Hannauer was responded to, on behalf of the association, by C. E. Smith, vice-president of the N. Y., N. H. & H., and a past president of the association, who, after expressing the pleasure of the association with Mr. Hannauer's cordial welcome and its meeting in Boston, reviewed many of the traditions and interesting side-lights of New England, its railways, industries, and its people.

### President Baluss Reports for Year

Shortly after calling the convention to order President Baluss reviewed the work of the organization during the last year. He reported a total membership of 755, a net gain of 5 during the year, and a surplus of approximately $1,000 in the treasury. He then referred to the place of this organization in railway association work, speaking in part as follows:

"The field of the American Railway Bridge and Building Association is a distinct one, and does not overlap or merge with any other railroad organization. There seems to be a misunderstanding in the minds of some railway officers who think there is a duplication of effort of this organization and the A. R. E. A. The men who meet here, and the matters and methods they discuss, are entirely separate from those of the A. R. E. A. The latter association, within the limits of its time, cannot discuss the practical side of bridge and building work, nor does its membership include many men who are in direct charge of men performing such work. This association supplies a contact and outlet for men who are re-

# Men Gather in Convention



## Annual Meeting in Boston Which a Wide Variety Were Discussed

sponsible for the expenditures of millions of dollars of railroad funds annually. Can there be any doubt of the resultant value such men will obtain from the interchange of ideas on the floor of this convention?"

### Officers Elected

At the concluding session of the convention the following officers were elected to serve for the ensuing year: president, Maro Johnson, assistant engineer, I. C., Chicago; first vice-president, J. S. Huntoon, assistant bridge engineer, M. C., Detroit, Mich.; second vice-president, C. S. Heritage, bridge engineer, K. C. S., Kansas City, Mo.; third vice-president, A. I. Gauthier, supervisor bridges and buildings, B. & M., Concord, N. H.; fourth vice-president, H. I. Benjamin, assistant engineer of bridges, S. P., San Francisco, Cal.; secretary-treasurer, C. A. Lichty (re-elected), inspector, C. & N. W., Chicago; assistant secretary-treasurer, F. E. Weise (relected), chief clerk, engineering department, C., M., St. P. & P., Chicago; directors, W. A. Batey, general inspector bridges and buildings, U. P., Omaha, Neb.; F. W. Hillman, assistant engineer maintenance, C. & N. W., Chicago, and G. A. Rodman, general supervisor bridges and buildings, N. Y., N. H. & H., New Haven, Conn. New Orleans was selected as the location for the next convention.

At the same session the following suggestions were presented by the Committee on Subjects for consideration by committees for the ensuing year: 1. The Selection and Training of Men for the Position of Foreman. 2. Wearing Surfaces for Passenger and Freight Platforms. 3. The Relative Economy of Concrete Mixes and Practical Tests for Concrete Aggregates. 4. Reducing the Cost of Maintaining Roadway Buildings and Small Stations. 5. The Inspection and Maintenance of Track Scales. 6. The Maintenance of Inclines and Other Water Transfer Facilities. 7. The Protection of Underground Lines from Deterioration. 8. The Elimination of Accidents to Bridge and Building Men Working Off the Ground.

# Motor Trucks for Handling Bridge and Building Materials

THE economies effected by the substitution of motor trucks for work trains where the work and other conditions justifies, and the elements to be considered in the choice of motor truck equipment, were considered at length by a committee. In its report, it included a tabulation of the cost of operating various sizes of motor trucks, as being approximately correct for the vicinity of Detroit, Mich., but which was in such form that it could be adjusted readily for any locality. Figures were also presented, showing not only the direct monetary savings effected on various railways where trucks are employed, but also the savings in the use of revenue freight cars. This report follows in part.

The volume of traffic handled by the railroads since 1920 has caused congestion in yards and on main tracks by reason of the frequent train movements. In order to handle revenue freight more efficiently, some railroads have considered the substitution, as far as possible, of motor trucks for work trains for the handling of bridge and building materials and supplies. Where it is practicable to truck less-than-car-load lots of materials short distances, more equipment is available for revenue service. Consideration has been given to the increased cost of work train service, together with the small amount of actual working time, and also to the delays to work trains, caused by the time consumed between the terminal and the working point. Emergency repairs to coaling and water stations may also be expedited by trucking men and material, thus restoring the facilities to service and possibly eliminating overtime for other employees.

Suitable highways, preferably paved, between initial and terminal points, are essential for efficient trucking service. Due care should be used in the selection of the make and capacity of trucks, as those of a capacity greater than required result in unnecessary operating expense.

There is a tendency to ship light bridge and building supplies by baggage car; this practice should be discouraged where the haul is within the economical trucking radius of a terminal. A shipment of material and supplies by baggage car occupies space intended for other purposes, frequently delays the starting of trains, causes unnecessary train stops, requires additional time for loading and unloading at stations and additional handling by employees at the terminal. In some of the larger cities, terminal repair men are not permitted to transport cross-cut saws, and certain other tools on street cars, which makes it necessary to haul such tools to the working point by either baggage car, truck, motor car, push car or team.

### The Use of Trailers

Owing to the nature of the motor truck, the most expensive part, the power unit, must stand idle while the load is being handled. Every truck wastes considerable working time in this manner. The use of trailers reduces the idle time consumed in loading and unloading, when it is expedient to increase the average load. The increased load capacity is possible, because the load is distributed over more wheels and axles.

Stringent legislation limiting the allowable wheel or axle loads on public highways, makes the use of the trailer method imperative where large loads must be hauled. Where there is a necessity of adapting the trailer to loads so awkward in shape, bulk or weight that the motor trucks cannot handle them profitably, the trailer can be designed to meet these exacting requirements.

The trailer method of transporting material cannot be applied to every hauling problem. It is questionable whether it can be applied to the distribution of bridge and building materials, owing to the character of the materials to be hauled, facilities for loading and varied points for delivery. The power unit is necessarily larger than required of trucks for hauling bridge and building material for most railroads. In numerous cases it is more advantageous to employ two trucks of 1½-ton capacity than to purchase one heavy power unit and trailer.

### The Cost of Operating Trucks

The cost of work train service varies from $12 to $17 an hour on addition and betterment work and from $5 to $7 an hour on maintenance work. Train crews seldom receive less than 12 hours pay per day. This class of service costs, therefore, from $60 to $204 a day. The cost of transporting car-load lots of material varies from ½ to ¾ cents per ton mile.

Motor truck transportation should be approved only after a scientific survey and analysis of the haulage problem has been made in each individual locality. Having a thorough knowledge of the situation, the bridge and building executives should recommend the units to render efficient service at the lowest cost.

A superior truck does not necessarily insure superior transportation. Much depends upon the truck's application, the proper auxiliary equipment, its adaptability to the work and conditions governing its use.

In estimating the cost of any truck installation, the first step is to decide upon the size and type of equipment. The user should know his average daily tonnage in both busy and dull seasons and the average length of haul. If this information is not available, it should be secured by the use of rented trucks so that the railroad management can determine the size and number of motor trucks required.

The accompanying table shows the daily operating costs of trucks, taking into consideration the capacity of the truck, the distance operated per day, and fixed and variable charges. The information was obtained from large trucking contractors and manufacturers and the committee believes that operating costs shown are approximately correct for the vicinity of Detroit, Mich. Before determining the operating costs of any one locality each item shown in the table should be adjusted.

No allowance has been made in the table for overhead or administration charges, such as clerical salaries, office rental, supplies, telephone, etc. For an economic comparison with various other transportation costs, it is better to consider the actual operating cost of equipment alone.

The committee recommends the foregoing form for estimating trucking transportation costs. The items which make up the costs are considered in detail, such as initial cost of equipment, fixed expense, running expense and pay roll expense. With the expenses itemized in this manner, the unit cost can be obtained readily per day, mile, round trip or ton mile.

**Motor Trucks Are Used for Delivering Material on the Southern Pacific**

The prices of trucks are usually quoted on the chassis f.o.b. factory. The cab and body should be selected for the requirements of the service. There is a wide variation in price, due to difference in design. The following prices with respect to capacity are only approximate:

| Capacity in tons | Cost, including stake body |
|---|---|
| 1 | $1,000 to $1,725 |
| 1½ | 610 to 2,291 |
| 2 | 1,645 to 3,750 |
| 2½ | 3,325 to 4,525 |
| 3 | 2,185 to 3,750 |
| 4 | 4,870 to 5,100 |
| 5 | 5,400 to 5,942 |

### Savings by Using Motor Trucks

The use of motor trucks for handling bridge and building material should be considered from the standpoint of economy. The indirect benefits are the saving of freight cars for revenue service. The Chicago, Milwaukee, St. Paul & Pacific, with 12 trucks in service, saves 50 revenue cars daily; the Southern Pacific saves one-half of a revenue car per day for each truck in service; the Elgin, Joliet & Eastern, with one truck, saves from one to two cars per week.

It is difficult to estimate the direct saving, as there are factors entering into the situation on which no data are available, such as emergency repairs to coal and water stations, repairs to crossing gates and highway bridges in terminals, delay to revenue trains in terminals from the use of busy tracks by push cars or motor cars, the use of commercial sidings with cars of company material, and the expense involved in switching cars of company material.

The Southern Pacific estimates that trucks will save

COST OF OPERATING TRUCKS PER DAY

| | CAPACITY OF TRUCK IN TONS | 1 | | | 1½ | | | 2 | | | 2½ | | | 3 | | | 4 | | | 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GASOLINE-MILES PER GALLON | 15 | | | 10 | | | 7 | | | 6½ | | | 6 | | | 5 | | | 4 | | |
| | MILES OPERATED PER DAY | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 | 40 | 60 | 100 |
| FIXED CHARGES | ANNUAL INTEREST | $ .19 | $ .19 | $ .19 | $ .22 | $ .22 | $ .22 | $ .28 | $ .28 | $ .28 | $ .38 | $ .38 | $ .38 | $ .44 | $ .44 | $ .44 | $ .57 | $ .57 | $ .57 | $ .76 | $ .76 | $ .76 |
| | INSURANCE | .23 | .23 | .23 | .27 | .27 | .27 | .26 | .26 | .26 | .28 | .28 | .28 | .28 | .28 | .28 | .41 | .41 | .41 | .64 | .64 | .64 |
| | DRIVERS WAGES | 5.75 | 5.75 | 5.75 | 5.75 | 5.75 | 5.75 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 |
| | GARAGE | .50 | .50 | .50 | .50 | .50 | .50 | .70 | .70 | .70 | .70 | .70 | .70 | .80 | .80 | .80 | .80 | .80 | .80 | .80 | .80 | .80 |
| | LICENSE | .12 | .12 | .12 | .15 | .15 | .15 | .20 | .20 | .20 | .29 | .29 | .29 | .41 | .41 | .41 | .50 | .50 | .50 | .58 | .58 | .56 |
| VARIABLE CHARGES | GASOLINE @ 7¢ GAL | .40 | .60 | 1.00 | .64 | .96 | 1.60 | .80 | 1.20 | 2.00 | 1.00 | 1.50 | 2.50 | 1.08 | 1.62 | 2.70 | 1.32 | 1.98 | 3.30 | 1.60 | 2.40 | 4.00 |
| | LUBRICANTS | .12 | .18 | .30 | .12 | .18 | .30 | .16 | .24 | .40 | .16 | .24 | .40 | .16 | .24 | .40 | .20 | .30 | .50 | .20 | .30 | .50 |
| | TIRES (20,000 MILES) | .24 | .36 | .60 | .40 | .60 | 1.00 | .62 | .94 | 1.57 | .76 | 1.14 | 1.90 | .96 | 1.44 | 2.40 | 1.20 | 1.80 | 3.00 | 1.20 | 1.80 | 3.00 |
| | OVERHAULING (2 TIMES / 1000 MILES) | .38 | .57 | .95 | .43 | .65 | 1.08 | .40 | .60 | 1.00 | .45 | .67 | 1.12 | .50 | .75 | 1.25 | .55 | .82 | 1.37 | .60 | .90 | 1.50 |
| | PAINTING | .04 | .07 | .11 | .05 | .08 | .14 | .06 | .09 | .10 | .09 | .13 | .22 | .12 | .18 | .30 | .12 | .18 | .30 | .12 | .18 | .30 |
| | RUNNING REPAIRS | .38 | .57 | .96 | .44 | .66 | 1.10 | .47 | .71 | 1.19 | .52 | .78 | 1.30 | .64 | .96 | 1.60 | .80 | 1.20 | 2.00 | 1.00 | 1.50 | 2.50 |
| | DEPRECIATION (100,000 MILES) | .68 | 1.03 | 1.72 | .91 | 1.37 | 2.29 | 1.14 | 1.72 | 2.87 | 1.33 | 1.99 | 3.32 | 1.52 | 2.29 | 3.82 | 1.94 | 2.92 | 4.87 | 2.37 | 3.56 | 5.94 |
| | TOTAL COST PER DAY | 9.03 | 10.17 | 12.43 | 9.88 | 11.39 | 14.40 | 11.09 | 12.94 | 16.57 | 11.86 | 14 10 | 18.41 | 12.91 | 15.41 | 20.40 | 14.41 | 17.48 | 23 62 | 15.87 | 19.42 | 24.50 |

**Daily Costs of Operating Trucks of Various Capacities**

50 per cent of the cost of moving material with a motor car or a push car, and 75 per cent of the expense of handling it with a work train. The Akron, Canton and Youngstown, with one truck, saves $1,200 annually.

An actual check on the Missouri Pacific showed a saving of 32 man-hours per day per truck as compared with the delivery of the same material with a push car or motor car. This time, computed at 60 cents per hour, makes a daily saving of $19.20, which would pay for the original investment in a 1½-ton truck in approximately 34 days. This saving of $19.20 a day, if extended over a period of 300 days, would amount to $5,760 annually and pay 6 per cent interest on $96,000, a sum sufficient to purchase about 130 trucks of 1½ tons capacity each year.

The Great Northern reports that it is impracticable to estimate the annual saving by using trucks to deliver material; however, the work is carried out more efficiently and there is no doubt that considerable economy is effected by using this equipment.

The first truck purchased by the New York, New Haven and Hartford saved enough in two months to pay for the original investment and leave a surplus to pay for gas and oil. It is estimated that each truck saves $1,000 annually. This saving of $1,000 per truck will pay the interest at 6 per cent on $16,666, which is sufficient to purchase 24 trucks of 1½ tons capacity.

It is estimated that the 15 trucks in service on the Delaware, Lackawanna & Western save $5,000 per year. Such a saving will pay 6 per cent interest on $83,333, for which amount 119 trucks of 1½ capacity could be purchased each year.

Committee: J. S. Huntoon (M. C.), chairman; G. S. Crites (B. & O.), vice-chairman; H. H. Best (M. P.); E. E. Candee (N. Y., N. H. & H.); A. J. Hart (A. C. & Y.); A. A. Kurzejka (C. M. St. P. & P.); E. L. Mead (C. & N. W.); D. T. Rintoul (S. P.); and C. W. Wright (L. I.).

**F. C. BALUSS**
**President**

**F. C. Baluss joined the American Railway Bridge and Building Association in 1914 and has taken an active part in its work since that date. As chairman of a committee, he prepared and presented a report on the Maintenance of Timber Docks in 1920. He was elected a director of the association in the same year and on the expiration of his term in 1923, he was elected fourth vice-president, advancing through the various vice-presidencies to president a year ago. He is the second man from the Duluth, Missabe & Northern to hold this office, W. A. McGonagle, now president of this road, having served the association in the same capacity in 1895. Under Mr. Baluss' direction the association has enjoyed a constructive year of progress.**

## Discussion

It was evident from the extended discussion of this report that there was a general unanimity of opinion in favor of the use of motor trucks by the bridge and building department, especially in and about large or congested terminals, although several emphasized the necessity of keeping these trucks busy if full economy is to be effected. C. W. Wright (L. I.) said in particular, that while his road was using motor trucks extensively and with large economy, they form an excellent opportunity to waste money unless their operation is carefully supervised.

C. R. Knowles (I. C.) pointed out certain considerations which should be given attention in turning to the use of motor trucks. "In considering truck installations," he said, "it is of first importance to establish, if possible, a system whereby the trucks will be used the greatest number of hours throughout the day. It is found frequently that the purchase of a motor truck can be justified by comparing the costs for a single operation, but if there is not sufficient work to keep the truck in use a fair proportion of time, it may prove more economical to rent a truck. We have found on the Illinois Central that we can contract for a truck at some points as low as $1.50 per hour, and where there is only two or three hours' work for the truck per day, this has proved more economical than maintaining and operating a company-owned truck." Mr. Knowles also pointed out that the stores department on his road showed a considerable saving through the use of motor trucks, and said that in spite of the recommendation of the committee against the use of trailers, they were being used very efficiently on his road.

The practice of using the trucks of the stores department was looked upon most favorably by several for small roads where there is limited use for a truck in bridge and building work, and several instances were pointed out where this practice is working out satisfactorily. C. W. McCandless (S. P.) said that while he used to depend upon the stores department trucks on the Los Angeles division of this road the demand for the trucks has increased to such an ex-

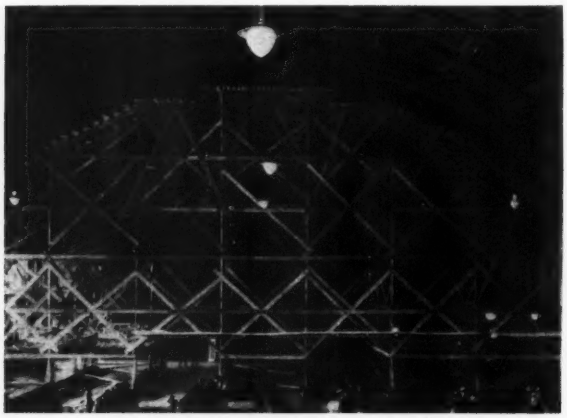
tent that he now has two trucks for his own use, and finds that with these he secures more prompt and effective service in the handling of men, tools, and materials than it was possible to secure under the old arrangement, whereby he had to depend on another department for service.

Charles Ettinger (I. C.) told of the extensive use of trucks on the Chicago Terminal division of the Illinois Central, particularly since the electrification of all suburban traffic led to an order forbidding the shipping of bridge and building materials on suburban trains. He said that they now keep four trucks busy constantly and then sometimes have to call upon the stores department for assistance. Mr. Ettinger pointed out that what little time the trucks are idle is used by the drivers in keeping them clean and in repair. He also pointed out the value of motor trucks in emergency work, and cited several instances where the trucks on his road had been used most effectively in this respect.

F. M. Griffith (C. & O.) estimated that two trucks on his territory are effecting a saving of 50 per cent on their investment for the movement of men as well as tools and materials. W. T. Krausch (C. B. & Q.) said that a truck purchased in connection with a certain piece of reconstruction work at Denver paid for itself and showed a profit of about $1,000 in addition, on this job, while after the work was completed, the truck was turned over to another department for further use.

# The Painting of Railway Stations and Allied Buildings

THE committee devoted much of its report on the painting of stations and similar buildings to the importance of programming the work and the organization of the gangs to carry out the program in such a way that they can be kept employed during the entire year, thus insuring the retention of experienced workmen. The economy of purchasing ready-mixed paints was discussed and the statement made that the information secured indicates that roads using large quantities of standard colors can buy and mix the ingredients in properly equipped plants cheaper than they can buy ready-mixed paints. The fundamentals of spray painting were presented, and considerable attention was given to the subject of interior painting, especially of large passenger stations. An abstract of this report follows.



**Scaffold for Painting Waiting Room in Illinois Central Station at Chicago**

If the painting of buildings is done in a haphazard way, the general effect is unsatisfactory and much time will be lost in moving gangs back and forth between more or less widely separated places. A newly painted structure among buildings that are greatly in need of paint attracts undue attention to the shabby condition of its neighbors. To remedy such undesirable conditions, it is necessary to lay out each season's work in such a way that all of the buildings along a given stretch of road shall be painted and then to begin the next season's work where the previous season's work ended.

Repairs should be made to all buildings before the painting is begun so that no unsightly patching and spot painting will be necessary. This requires a program of carpentry, sheet metal and other repairs that shall be in harmony with the painting program. Such repairs should be sufficient to carry the structure without further attention for as long a time as it is anticipated that the new coat of paint will last.

### Separate vs. General Utility Gangs

The question as to whether separate gangs should be organized for bridge painting as distinguished from building painting is influenced greatly by local conditions. The tools, paints, cleaning, scaffolds and methods are different and each gang will do more economically the kind of work that it is used to doing.

On some roads the bridge painting is done by what is known as a steel gang, such gangs taking care of both the repair and painting of steel bridges; some use separate bridge-painting gangs for the larger structures and have the smaller bridges painted by house-painting gangs in connection with their regular schedules, while still others use their bridge-painting gangs, during the winter and at other times when not employed at painting, for renewing ties, placing concrete and other work. A gang used in this way must be in charge of a good all-around foreman, but such a plan aids in keeping the gangs employed throughout the year and leads to greater efficiency and loyalty on the part of the men.

On roads where the volume of work warrants, the building work should be handled by a separate painting organization. Men so engaged are working among the traveling public a great deal of the time. They are often approached for information and should present a cleaner and neater appearance than is necessary in bridge work. In station work, it is also more necessary that the men be trained to understand and guard against damage and accidents to travelers and the general public, in addition to avoiding injury to themselves and their mates.

### All-Year-Round Work

It is economy to keep a limited number of painters employed throughout the year, rather than to put on large gangs of inexperienced men for a few months. The smaller gangs of regular employees are accustomed to railroad work, trained to have regard for the comfort and safety of the traveling public, and will do satisfactory and economical work.

The interiors of large structures, such as office buildings, large freight or passenger stations and shops, should be painted in the winter months. Painting the interior of other passenger stations, freight houses and roadway structures should be done while the gang is there on the regular schedule, both to avoid the expense of moving back again to complete the unfinished work and to eliminate a second period of discomfort to the public and others using the facilities.

The most economical way to get gangs to and from work depends upon local conditions. In large terminals, where there are many buildings near together, it is usually possible to have the paint and the painting equipment moved to and from the several buildings by motor trucks. For general work out on the line, gangs should be worked from boarding cars. Such cars not only provide a place for the men to live in, but also nearby storage and a means of general transportation for their paints, scaffold and other equipment. All boarding car gangs should be provided

with motor cars for transporting men, materials and equipment between the boarding cars and the work in hand.

The general belief appears to be that it is better to buy ready-mixed paints, although such information as we have gathered indicates that ingredients can be bought and paints mixed by railroads that have plants properly equipped for doing the work, at a cost uniformly less than that of ready-mixed paints made to the same specifications. This applies only to mixing the standard colors that are used in large quantities. Any attempt to mix many different colors, in a small plant of limited equipment, will result in higher cost on account of the frequent cleaning of the mixers and mills, made necessary in handling small batches of different colors.

The prejudice that exists generally against painting structures built of brick, stone or concrete is due to the fact that, in themselves, such materials are decorative. This is especially true of all natural stone, of carefully manufactured face brick and of terra cotta. Such materials should seldom or never be painted. It is true, however, that structures of common brick often become unsightly through the disintegration of the softer bricks and from other causes. The appearance of such buildings can be greatly improved and their life prolonged by proper painting. Also, structures built of such materials are often painted to bring them into a harmonious color scheme with adjacent buildings. There are many good paints that are made especially for this use, and as a rule it will prove most satisfactory to buy such paints and apply them as specified by the manufacturer.

The colors for interior painting are usually chosen with a view to producing a pleasing decorative effect, while the vastly more important consideration of interior illumination is given little thought. Badly lighted rooms engender gloom and discontent and are a fruitful cause of eye strain and impaired vision for those who work therein. Dark corners and closets are an invitation to filth and untidiness. A soft, all-pervading light without shadows is the ideal condition and this can only be attained by the use of very light colors for interior painting. White walls and ceilings reflect the light in all directions, breaking up the shadows and making all corners light.

### Spray Painting

Spray painting is a subject by itself and should be handled as such, but as it is coming into more general use each year, a few of the outstanding points should be mentioned. The equipment should be selected from among the many different outfits furnished by reliable and experienced manufacturers, care being taken that the equipment chosen is capable of actually atomizing the paint. Paint thrown on without proper atomization will be laid on too heavily and will need to be brushed out. This is wasteful, inefficient and unnecessary and, with proper equipment, is entirely the fault of the operator.

One inherent fault with this method of painting is due to the fact that the humidity of the air is much increased by compression. The equipment should be provided with some means of extracting this moisture from the air, as an excess amount of water in any form greatly injures the paint film. Nearly all equipment offered is provided with some kind of a moisture separator, but it is not standard equipment and must be especially ordered.

Home-made equipment is bad and discredits spray painting. Its use should be discouraged. Given proper equipment and competent operators the spray method will do first-class work with little or no additional use of material and at a very considerable saving in labor.

With the exception of large special jobs, the experienced painter on general work prefers to do his own scaffolding. This should be encouraged, as it will make it unnecessary for other mechanics to act as attendants and will make the painter more self-reliant and resourceful, as well as more careful. To accomplish this, it follows, of course, that the

## American Railway Bridge and Building Association Officers, 1927-1928

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Office Engineer, Duluth, Missabe & Northern, Duluth, Minn.

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Assistant Engineer, Illinois Central, Chicago

J. S. HUNTOON, Second Vice-President
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proper rigging and tools must be provided. Such equipment should not be clumsy, crude, heavy, home-made affairs, but standard goods procured from reliable specialty manufacturers. The tools should be kept for the sole use of the painters, who can then be held fully responsible for their proper and careful use.

Supervisory officers should inspect such painters' equipment frequently while it is in use on the job and discuss with the painting staff the safe and proper way of handling ladders, planks, scaffolds, etc., so that the equipment shall not only be kept in good repair at the lowest expense, but at the same time the ideas of "safe men, safe methods" shall be inculcated in the mind of every man. Special jobs require special treatment and appropriate scaffolding must be designed to meet the individual needs of the job in hand.

Committee: K. Peabody (N. Y. C.), chairman; H. C. Archibald (B. & M.), vice-chairman; Chas. Ettinger (I. C.); T. E. O'Brien (D. & H.); G. A. Rodman (N. Y., N. H. & H.) and E. P. Self (L. I.).

### Discussion

In discussing the quality of the paint used A. H. Sabin (National Lead Co.) emphasized the fact that the quality is of first importance, whether paint be purchased ready mixed or in its elements and mixed on the job. If bought ready mixed, he said, it should be on definite specifications with the understanding that the company furnishing the paint will be held strictly accountable. Mr. Sabin also pointed out the long life of wooden structures properly protected by paint, citing examples of houses built in the seventeenth century which are still in a good state of preservation. He also emphasized the false economy in saving a small amount in the cost of inferior paint, when the labor forms such a large percentage of the total cost of painting work.

Another point which received prominent attention and on which there seemed to be general accord, was that one of the first essentials in securing good painting is to put the work in the hands of intelligent and competent foremen who are familiar with both paint materials and their application. The importance of having well trained and competent inspectors was also pointed out.

While methods of applying paint were not discussed, mention was made of the adaptability of the paint spray gun for certain classes of work and in this connection, H. A. Gerst (G. N.) mentioned the good results being obtained through the use of a new type low pressure spray gun, in which the mixture of paint and air takes place inside the spray nozzle, instead of just in front of it.

# Co-operation Between Store Department and Field Forces

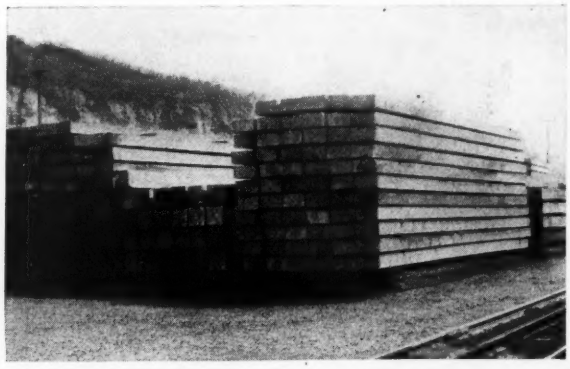
CLOSE co-operation between the stores and the using department was recommended in a committee report which was based on a study of the methods employed on various railways in the supplying of materials. The report covered the issuance of requisitions, the delivery of material, the control of line and emergency stocks, excess material and reclamation, and recommended the adoption of an annual program of work so that the stores department may be able to budget its requirements as far in advance as possible. Replies to a questionnaire indicate that many roads have been able to reduce the amount of materials carried in stock by establishing close co-operation between the stores department and the using departments. This report follows in part.

The general storekeeper is usually the custodian of all materials and supplies, not only those still upon the shelves in the store house or in the stores' material yards, but also those issued to the using force in the field and which remain unused. It is this detached inventory that often causes misunderstanding with the men in the field. If it is not properly supervised by the using department, the general storekeeper needs to exercise his authority, as custodian, to direct this unused material into channels where it will ultimately be consumed.

The bridge and building supervisor is responsible for the maintenance of valuable property. Safety of operation depends upon the physical condition of this property; and this in turn depends upon its upkeep, through the judicious use of the materials and labor entrusted to his care. It should be understood that this material cannot always be used immediately. It is also necessary that sufficient material be kept on hand at all times to meet such emergencies as may arise on each supervisor's territory. Although he is not the custodian, even though this material is charged to him, the supervisor still feels that he is the better judge of what is needed in the field.

The season's programs are planned and the material is ordered; as the work progresses, crews are shifted as nearly as possible to conform to the program, and the supervisor expects delivery of the material a reasonable time before the crews move to a job. In other words the supervisor wants service. Setting up the problem in this manner, it is now desired to find out how these two departments can best co-operate.

The first point of contact with the store department arises in the ordering of material. Usually seasonal requisitions are made on the general storekeeper by a general officer of the using department. For some work, requisitions are made direct on the local storekeeper by the division officer; generally, however, requisitions are prepared by division officers, sent to the department head for approval and then to the general storekeeper. It usually



**Line Stocks Should Be Maintained Carefully**

requires from 5 to 10 days from the date of issuance of the order to the date of delivery of material in stock. Material which must be purchased requires from 15 to 90 days, depending upon its character and quantity.

### Recommendations

1. The committee does not propose any change in the methods used by the various railroads in presenting requisitions to the general storekeeper, although these vary considerably; but the men in the field, knowing the routine that must be followed, should take this into account when ordering material.

2. It is the duty of the using department to make a careful and detailed inspection, at least once a year, of the property under its supervision and from this inspection to prepare a forecast of the material needed for repairs for the ensuing year or season.

3. Blanket requisitions are also to be prepared on estimates so that material may be purchased on a competitive basis and carried for use when needed.

4. A program should be prepared, showing in detail the work to be done, the material necessary for each project and the anticipated date the repairs will be made, so that the material will be on the ground by the time the repair

work is scheduled to be done. Storekeepers should not deviate from the program, but should send the material as specified.

5. The using department should exercise care in preparing requisitions, to specify the kind and quality of material needed. Special items should show the manufacturer's name, catalog or bulletin number, item and page number.

6. A better understanding between the stores and using departments is essential. There is a tendency for the using department to requisition everything for immediate delivery. This frequently causes material to be delivered long before it is needed and tends to belittle the significance of the term "RUSH" on requisitions when material is really wanted at once.

7. Requisitions should in all cases show the date that material is required in the field.

## Delivery of Material

Several methods are used in distributing material from the general or division store to the using department, including (a) Regular scheduled supply trains; (b) l.c.l. freight; (c) supply cars on local freights, and (d) carload shipments.

In the operation of the supply train, and in some cases, the supply cars, division officers and representatives of the store department accompany the train. In this manner, a good inspection of the property can be made, material stocks checked up and any controversy regarding the amount of stock carried can be settled while the train is there. Maintenance men assist the store department in handling this material.

Locomotive or smaller rail or caterpillar cranes, equipped with electric magnets, are being utilized in unloading track materials and picking up scrap, reducing train hours as well as eliminating a great deal of maintenance labor. The materials generally handled in these trains are track fastenings, frogs, switches, oil and similar supplies for the track department, small hardware for the bridge and building department, oil and waste for water stations, oil and some small material for the signal department.

The l.c.l. method of handling material is not as reliable as the supply car or supply train and often causes delays in delivery, owing to material going astray at transfer points, the misplacing of way bills, poor marking, or other causes.

The straight carload shipment is probably best fitted for the handling of bridge and building materials, as lumber, cement and bulky supplies can be shipped direct to points designated by the supervisor and then handled either by local freight or by work trains.

### Recommendations

1. The supervisor should take into consideration the method of delivery of material and govern the issuance of requisitions accordingly.

2. The general storekeeper, being the custodian of the material until it is used, should ask advice of receipt of all material, especially if the l.c.l. or straight-car method is used, and if the material has not been received it should be traced. Duplicate shipments should be avoided as far as possible, but work must not be delayed and, if lost material cannot be located after a reasonable time, a second shipment should be made.

3. Supply trains should be utilized for all classes of material possible. It is found that trains equipped with cranes facilitate the handling of bridge and building as well as track material.

## Line Stock

Line stock can be considered to include all unapplied material not located in store buildings or yards and should have the supervision not only of the store department but of the using department as well and its disposition should be made to the best interests of the railway. The storekeeper should inquire from the division officer in charge of supervision, to ascertain what is causing any delay in the use of material and go over all details of back haul or other items that are liable to cause an increase in operating costs, before any definite action is taken.

On the other hand, it would be fair for a maintenance officer to reject a shipment of material, which is in excess of his program, or which has been received too late for current use. The chief aim of the store department should be service. The assistant storekeepers on the line should act more as advisers than supervisors. In this manner, division maintenance officers can often be made aware of conditions that possibly can be corrected by a change of program that will effect an ultimate saving to the railway.

### Recommendations

1. The using department can co-operate by reducing as much as possible the accumulation of material on the line. Requisitions should be made for current needs only.

2. The stores department, by personal contact with division officers and supervisors, can accomplish a great deal by calling attention to slow-moving stock and urging the advisability of moving it. Careful consideration should be given to back haul before material is moved.

3. Schedules should be prepared which should have the approval of the engineer of maintenance, as well as the general storekeeper, showing the amount of material each bridge outfit, section tool house or signal maintainer should carry in stock for current needs, determined by the method of delivery in use.

4. All excess material should be returned promptly after the completion of a special job.

## Annual Program

As stated previously, the general storekeeper should be fully advised as to the material requirements for the coming year. The field force, however, should determine when the material is to be used and delivered. We all realize the difficulty of carrying out such a program in full. Emergency work, such as washouts, fire, or A. F. E. work that requires immediate attention, often causes sudden changes in the season's schedule.

This committee feels that, in its effort to bring about proper co-operation with the stores department, the general storekeeper should be notified of any change to be made in a program.

Some roads have adopted a budget system for material, made up from the season's program. This system has proved satisfactory from the viewpoint of the stores department and has shown a marked decrease in line stock especially, and a decided decrease in operating expenses.

### Recommendations

1. Maintenance work should be programmed by each division and consolidated in a general program by the engineer maintenance of way.

2. Upon confirmation of the program or budget, the division engineer and supervisor should arrange programs with the local storekeeper for the delivery of material.

3. Division officers in the using department should notify the local storekeeper of any change in the program affecting the delivery of material. The engineer of maintenance and the general storekeeper should receive copies of this notice.

4. To avoid loss through theft or other causes, material for specific jobs should be assembled at the general stores before shipment. To avoid delay, the date of delivery should be plainly stated on the requisition. The general storekeeper should notify the division officers when there is a possibility of delay in obtaining material so that the program can be changed in the field to meet this contingency and the crew's program rearranged accordingly.

## Excess Material and Reclamation

The handling of excess material must be taken into consideration at the time the work is completed. A good supervisor will remove part of his force as the work nears completion and naturally hesitates about bringing the men back. Again, it may be necessary to use a work train to pick up this material and division officers hesitate about ordering a train until absolutely necessary. In the meantime, this material is carried on the books of the general storekeeper as surplus stock.

A situation like this can be handled, (1) by holding a gang in the vicinity until the completion of the work and then loading the material, using a work train if necessary; (2) where a supply train is used and the time required for loading the material will be of short duration, division officers should take steps to see that cars are placed in the train for the excess material; (3) if the work is between regular stops of local or way freights arrange to stop the train from time to time as the various classes of materials are found to be in excess, and load and return them to the general stores; (4) as material is recovered it can be brought to the nearest station and piled, awaiting disposition.

Reclaim yards are generally under the control of the general stores department, but in a few instances we find that the using department has charge of them. Where the using department has control of the yards, we find a more satisfactory classification of the material and the

Some of the Officers of the Association

forces in the field are assured of a better class of usable material being sent out. This results in a saving in operating expense; (1) in the possible elimination of back haul of material; and (2) a more accurate salvage system, eliminating the unnecessary purchase of material and the classifying of serviceable material.

## Emergency Stock

Emergency stock, when stored at points other than the general or division stores, must be considered as line stock and handled by the general storekeeper. In the study of this item we find that maintenance of way officers are generally in favor of storing this material at division stores, where a crew can generally be loading cars while the work train is being called and made up. The location of the material yard must be taken into consideration, as division or district stores should be located centrally to be effective. Another consideration that enters into this problem is the amount of material that may actually be required in an emergency. Where emergency stock is stored at points outside of division headquarters, care should be taken to insure that material is left on the ground for a limited time only, to prevent deterioration. Supervisors should give this stock careful inspection from time to time. As a general rule, all emergency stocks should be kept at division stores, as far as local conditions will permit.

Emergency stock for water supply is generally kept at the headquarters of the supervisor of water supply. As this is line stock and is carried as surplus by the general stores, it is under the control of the general storekeeper until used. Where pumps and water cranes are standardized over a division or district this material could be kept in stock at the division stores, with a strict understanding that no shipment will be made until after conference with the supervisor of water supply.

## Meetings

One method of bringing the using department into closer touch with the store department is effected through the holding of meetings at stated intervals. Such meetings lead to better co-operation between all parties concerned.

### Conclusions

The total value of supplies carried in stock and on hand by 114 roads at the close of 1927 amounted to $518,583,494, a reduction of approximately $27,000,000 from the figure at the close of 1926. Of these 114 roads, 71 showed reductions while 43 showed increases.

In 1926, U. K. Hall, general supervisor of stores, Union Pacific System, summarized the cost of carrying materials as 15 per cent. We believe that this figure is conservative, but using it as basis for computing the cost of carrying this material on hand during 1927, we find that the expense for carrying this large inventory amounts to practically $77,700,000. It may also be of interest to note that where the replies we have received to questionnaires state that close co-operation exists between field forces and the store departments, we find that these same roads are included in the reduction column.

The control of stocks of materials is the general storekeeper's burden, and it behooves all using departments to help him with the load. Reduce line stock to the minimum and better service on your requisitions will result. A carefully planned program should bring systematic delivery of material.

Committee: L. M. Bates (C. & N. W.), chairman; G. T. Richards (C. M. St. P. & P.); W. A. Hutcheson (C. & O.); J. E. King (C. & O.); R. W. Mitchell (B. & O.); C. A. W. Musson (C. M. St. P & P.); A. W. Reynolds (Penn.); Wm. Shively (C. R. R. of N. J.); T. E. Snyder (B. R. & P.); and W. G. Swartz (C. N. R.).

### Discussion

The discussion on this report showed that those present were heartily in favor of closer co-operation between their own department and the stores department, and many suggestions were made to this end. W. T. Krausch (C. B. & Q.) pointed out that all of the delays in the receipt of material are not due to the stores department, and further, that many delays start with the failure of the bridge and building man to consider field conditions when making requisitions. He also said that when material is received, it is of utmost importance to check it against the requisition immediately to detect errors promptly and avoid the necessity for rush or emergency requisitions later.

The use of the words "rush" or "emergency" on requisitions was critized by several. Among these were J. S. Huntoon (M. C.), C. R. Knowles (I. C.) and P. Hofecker (L. V.) who pointed out the increasing ineffectiveness of this practice. In its place, Mr. Huntoon urged that the date on which the material is desired be stated specifically, which, he said, would give the storekeeper something definite to work on. He outlined the manner in which the head of a department on his road can go to the purchasing agent in an emergency and get an order on a local dealer for immediate delivery. He said further that most complaints against the quality of tools furnished can be traced to lack of specification on requisitions, "for I have found that if a specific grade of tool is requested, it is usually furnished."

Mr. Hofecker said that he has given up the use of the term "rush" as ineffective, and for a long time has been putting the date of delivery on all requisitions. "By so doing," he said, "I can map out my work program and be sure that the stores department knows exactly when I need the material requested. Further, this prevents the accumulation of materials on a job

and does away with the necessity for storing and rehandling."

H. I. Benjamin (S. P.) reported that, in addition to putting the date of delivery on a requisition, it is the general practice of the storekeeper on his territory to call up the maker of the requisition five days before the date of delivery, to check the date, material, and method and place of delivery. He pointed out that this has proved very effective for the last three or four years. W. A. Batey (U. P.) said that he used the term "rush" only when absolutely necessary, and then stressed the importance of making requisitions clear and giving the storekeeper as much time as possible to fill orders. Chas. Ettinger (I. C.) pointed out the importance of maintaining a close and frank relationship with the stores department, and the necessity for the exercise of diplomacy on the part of all concerned in the handling and ordering of supplies and materials. "Getting together with the stores people and laying your cards on the table," he said, "will solve most of the problems complained of."

Mr. Knowles emphasized the importance of keeping the stores department informed of requirements as far in advance as possible so as to permit proper handling, and also to help in the reduction and control of stock. On this latter phase of the subject he laid special emphasis, speaking in part as follows: "The committee shows in its report that an annual expense of 15 per cent is a conservative cost for carrying material. It is not the part of good judgment, therefore, to carry an excessive stock, or material that may remain on hand indefinitely. Your particular stock of material may not appear to represent any great expenditure, but when multiplied by the many similar supplies over the entire railroad it assumes great importance." After citing the large reduction which has been made in the stock carried by the Illinois Central during the last five years, he said, "The requisition is a most important factor in the control of materials and one of the most important in preventing the waste of material. It is apparent, therefore, that the making, checking and handling of requisitions is of vital importance in controlling the abuse and waste of material. Making requisitions for material in excess of the actual requirements is the principal factor in causing large and small accumulation of unapplied material, usually designated as line stock. A successful dealer in any commodity gages his orders by his sales, as he realizes that the greatest profit is made from a quick turn over, and that material remaining on shelves is more likely to prove a liability than an asset. The same business principle should be applied to requisitions for material used on a railroad." T. E. Snyder (B. R. & P.) and E. C. Neville (C. N.) then told of the effectiveness of special meetings on their roads to devise the best means of keeping down the size of stocks carried and the most effective way of disposing of surplus materials on hand.

# Jacking or Tunneling for Placing Culvert Pipe

THE economies in placing culvert pipe by jacking or tunneling in lieu of the open-cut method are set forth in a committee report which was based upon information gathered from roads on which these methods have been employed. Aside from the direct savings in money, attention was called to the indirect savings resulting from freedom from interference with traffic and disturbance of the roadbed. The report, which is abstracted below, stated that any of the metal or concrete pipes commonly used for culverts can be installed by either of these methods where the character of the embankment permits.

The open-cut method of installing culvert pipe is expensive and the railroads, with the idea of reducing costs, and avoiding delays to traffic and damage to roadbeds, are making considerable use of the jacking and tunneling methods for culvert pipe installation. It must not be assumed that these methods will replace the trestle and open-cut method completely because there are many conditions under which it would not be practicable to jack or tunnel a pipe through a fill. However, the two last-named methods have very definite places in railway work programs. Judging from the information received, more culverts are placed by jacking than by tunneling.

The Cincinnati Northern has made extensive replacements of vitrified sewer pipe with cast iron pipe, and, for sizes up to 24 in., has forced them through the embankments without removing the dirt ahead of the pipe, by using a cone-shaped wooden plug at the end of the pipe, which pipe is started from the upstream side of the fill. The Cleveland, Cincinnati, Chicago & St. Louis has also used cone-shaped plugs in the installation of cast iron pipes of 12-in. to 24-in. diameters.

For the larger sizes of pipe, an open cut is usually made in the fill to a point as close to the track as is consistent with safety of train operation, and the jacking operations are then started with a man inside of the pipe to excavate a short distance ahead. An open cut is also made on the opposite side of the embankment in order to expose the end of the pipe and to discontinue jacking operations as soon as possible.

Care should be taken to pack the earth around the upstream side of the pipe to avoid possible scouring. In an installation on the Missouri Pacific, scouring was guarded against by making the last 6 ft. of the excavation about 6 in. smaller than the diameter of the pipe and forcing the culvert pipe through with the jack. This provided a seal on the upstream end of the opening which prevented the possibility of washing out around the pipe in cases of high water.

Several roads report the use of electric lights instead of ordinary lanterns for the men working inside of the pipe on account of the greater ease in handling and, also, because they generated less heat. On one job, a Ford automobile battery, with sufficient wiring to reach the entire length of the pipe, and a standard Ford headlight bulb, were used.

In most of the installations reported, the excavation was carried not more than 2 ft. in advance of the pipe and a clearance of from 1 in. to 1½ in. was made for the upper half of the pipe, while the grade line was followed as closely as possible for the lower half. If soil conditions permit, the excavation can be made farther ahead of the pipe and for wet soils, greater clearance around the pipe should be provided.

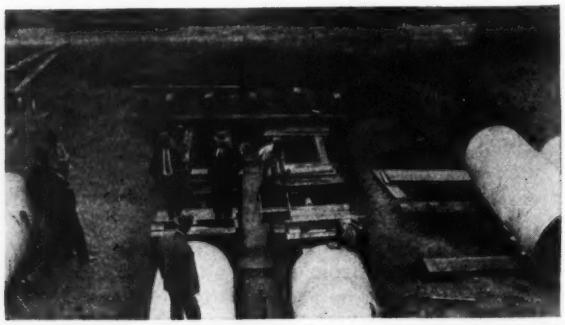
While most of the installations reported are of iron or steel pipe with riveted joints, the Big Four and the Cincinnati Northern use standard cast iron pipe and the Pittsburgh & Lake Erie reports the successful installation, by jacking, of 48-in. reinforced concrete pipe.

Evidently the work should not be stopped for any considerable interval on account of the danger of the dirt settling around the pipe and preventing further movement. The Delaware, Lackawanna and Western reported a case where a contractor, who was installing a 72-in. corrugated iron pipe under its main line, stopped work for two days and was then unable to move the pipe. The work was finally completed by jacking the remainder of the pipe from the opposite side of the fill.

Two installations were reported where it was necessary, on account of the length of the culvert, to jack the pipe from both sides of the fill, in order to avoid damage to the pipe. One of these was on the Lehigh Valley, where a 42-in. pipe 105 ft. long, was jacked through a 47-ft. fill, as described in *Railway Engineering and Maintenance* for May, 1926, and the other was on the Missouri Pacific, where a 48-in. culvert, 152 ft. long, was installed.

None of the roads using the jacking method of installation report any interruption to traffic or the placing of slow orders during the progress of the work and this is usually cited as the most important reason for using this method. Other advantages mentioned are: the small crew of unskilled men necessary; no work train service; no falsework required; if pipe shows signs of failing, another can be placed inside, and low cost as compared with the open trench method.

There is some difference of opinion as to the advisability of jacking pipe in cold weather. One road states that there



**Typical Arrangement for Jacking Pipe on the Missouri-Kansas-Texas**

is danger of the pipe freezing in, thus increasing the cost of jacking, while others say that the method is especially suitable for cold weather because the approach trenches can be brought closer to the tracks, thus decreasing the amount of pipe to be jacked. The method may not be suitable where the fill is saturated with water on account of the danger of the dirt running into the end of the pipe and causing a caving of the fill above. Also, for a fill composed of large stones or a fill made from a trestle where there would be danger of encountering the old piles, the method might easily prove more expensive than installation by open cut. However, the item of expense must be considered from the viewpoint of delays to traffic as well as the actual cost of installation, and the former may be more important.

In the summary of replies to a questionnaire, the estimated saving is shown as a percentage of the estimated cost of installation by the open cut method. Several of the replies gave labor costs, but on account of the variation in the sizes and lengths of pipes and the differences in soils in which they were placed, actual costs per foot are of little value except as items of interest, since they ranged from $4.87 per lin. ft. for 48-in. corrugated-iron pipe in hard clay to $8.47 per lin. ft. for similar pipe in stiff blue clay with some sand and boulders, and $10.42 for 48-in. rolled-steel pipe in field stone, coarse gravel and sand.

For installation by open cut in the lowest fill reported —8¼ ft.—where 42 ft. of 36-in. pipe was jacked through, the cost would be approximately $24.12 per ft. of pipe, based on the construction of a 2-bent trestle 14 ft. long, of usable timber and new untreated piles. There is a rapid increase in the cost of trestle work as the height of the fill increases. One road reported the installation of 120 ft. of 60-in. concrete pipe in a 36-ft. fill where the cost of the trestle was $50.78 per lin. ft. of pipe.

Placing pipes in fills by tunneling is an older method than jacking, but comparatively few roads have furnished detailed information about their installations. In driving tunnels, as much open cut as possible is made on both sides of the fill. While the size of the tunnel varies with the size of pipe installed, it is usually large enough to permit the use of wheelbarrows or small dump cars; for the smallest pipes it should be not less than 3 ft. by 5 ft. inside.

The method of timbering varies with the kind of soil encountered, in some cases requiring the sides and top to be fully supported, while in others the top only requires full support and bents placed at regular intervals for supporting the top were sufficient to hold the sides. Many roads are using second-hand 8-in. by 8-in. bridge ties on account of the availability of this material.

After the tunnel is completed, the pipe can be laid to an accurate line and grade and the backfilling can proceed as the pipe is laid. No cases were reported where any attempt was made to remove all of the timbering after completion.

No interruptions of traffic, other than the placing of slow orders, were reported by roads that installed pipes by tunneling. Other reasons for the use of this method were no disturbances of roadbed or track; less skilled labor required; no work train required except for the handling of material to the site of the work, and less material to be handled.

Opinions as to the saving effected by the tunneling method vary widely, but most users of the method state that there is a saving, based mainly on the lack of interference to traffic. Actual costs are governed by local conditions and therefore cannot be used as a guide to procedure for a new job. Few roads gave labor costs. One road reported the installation of a line of 12-in. cast iron pipe and a line of 14-in. cast iron pipe in two 3-ft. by 4-ft. tunnels, located in a 14-ft. fill and near enough together to enable one gang to handle both jobs, where the labor costs were $5.30 per ft.

Another road reported the costs of installation as shown in the accompanying table:

| Size of Pipe | | Cost of Installation | | |
|---|---|---|---|---|
| Diameter, In. | Length, Ft. | Labor | Material | Total |
| 24 | 56 | 8.78 | 1.55 | 10.33 |
| 24 | 64 | 9.29 | 1.52 | 10.81 |
| 24 | 80 | 9.35 | 1.47 | 10.82 |
| 36 | 80 | 11.80 | 4.07 | 15.87 |
| 48 | 112 | 7.05 | 8.18 | 15.23 |

Still another road reported an installation of 30-in. cast iron pipe in a 5-ft. by 6-ft. tunnel, 37 ft. below the case of rail. This work was done by a contractor and the price of $12 per ft. for the tunnel evidently included labor and material.

## Conclusions

Conclusions based on the information furnished are that:

1. The installation of culvert pipes by the jacking and tunneling methods is practicable for any sizes and kinds of cast iron, wrought iron, plain or corrugated steel and concrete pipes commonly used for culverts.

2. As compared with the open cut method, the advantages are: Less interference with train service; no slow orders; undisturbed roadbed; no cost of maintaining track over fresh fill after installation; no work train service; smaller force; less skilled labor and less total cost.

3. The disadvantages of either the jacking or tunneling methods are that they are difficult and expensive in very wet fills or in a fill made of large rocks. Also, there is more or less uncertainty in estimating the cost of the work by these methods and there is always the possibility that a change may have to be made to the open cut method, owing to conditions encountered in the fill which were not known at the beginning of the work.

Committee: F. H. Masters (E. J. & E.), chairman; W. H. Vance (M. P.), vice-chairman; A. E. Bechtelheimer (C. & N. W.); F. H. Cramer (C. B. & Q.); L. A. Gillett (F. E. C.); F. M. Griffith (C. & O.); B. M. Hudson (T. & B. V.); Peter Jenny (C. M. St. P. & P.); Samuel Lincoln (G. C. & S. F.); W. J. H. Manning (D. & H.); and G. A. Purdy (M.-K.-T.).

## Discussion

The discussion of this report showed that a large number of roads are using the jacking method extensively and with considerable success. In reply to a question by H. I. Benjamin (S. P.), Charles Gilman (Massey Concrete Products Corp.) stated that, with the exception of a little additional reinforcing steel, the concrete pipe used with the jacking process is similar to the standard pipe used when the installation is made by the trenching method. "This steel," he said, "is put in as an additional precaution against the increased stresses set up in the pipe while it is being jacked through a fill, although I am of the opinion that it is not necessary." Mr. Gilman then described the work of jacking concrete pipes through several fills, one of which involved a pipe 42 in. in diameter.

Mr. Benjamin stated that his experience indicated that the jacking method cost 33 per cent less than tunneling and only one-third the cost of trenching. A. B. Scowden (B. & O.) stressed the importance of analyzing the conditions existing at the site of each culvert installation, in order to prevent running into conditions unfavorable to the jacking method after the work has been well started. He stated that on his road earth borings are always taken first, and

a chemical analysis is made of the water that will reach each culvert. It has been his experience that the jacking method costs about one-half that of other methods. Mr. Scowden also stated that the type of old culvert to be replaced determines in large measure the type of new culvert to be installed. When jacking through an old terra-cotta pipe, he said that it is his practice to break up the old pipe as the new culvert is jacked through, while he is also considering the use of this same method where the old pipe is cast iron.

Mr. Benjamin then stressed the importance of making the jacking operations continuous, so as to prevent the freezing or settling of the surrounding ground, following which J. S. Huntoon (M. C.) stated that a jacking project which had been carried out on the Michigan Central cost $1,800, whereas it was estimated that it would have cost $3,700 to have done it by trenching. He said that the jacking method was resorted to as a means of avoiding interference with the 104 train movements over that section of line every 24 hours.

C. R. Knowles (I. C.) supplemented the report of the committee, which dealt primarily with large pipe, by describing the driving of certain relatively small pipe lines on his road by jacks and hydraulic rams. These included the driving of two eight-inch suction lines a distance of about 600 ft., and two ten-inch suction lines a distance of 190 ft. In all of the instances cited, he reported that economy was effected by this method.

A. W. Spalding (Ingot Iron Railway Products Co.) said that his company had installed over 600 culverts by the jacking method, with only three failures, and at an estimated saving of $1,200,000 over the cost of other methods. He described a special machine used for this work, and emphasized the importance, when planning to install corrugated pipe by the jacking method, of specifying pipe fabricated for jacking. F. M. Case (C. & N. W.) suggested that the first installation of a pipe be made large enough to permit renewal inside. In preference to this, Mr. Spalding suggested using the same size, and burning out the old culvert as the new culvert is installed.

# The Construction and Placing of Concrete Slabs

THE advantages in the use of precast slabs and other units for the decks of steel bridges, track-elevation subways and concrete trestles, as well as for foundations for railroad crossings and crossing planks for highway grade crossings, together with the precautions to be taken in the preparation and installation of the units for the various purposes, were set forth in the report of a committee which dealt with this subject and which follows in part:

The difficulty of casting concrete decks in place under traffic resulted in the adoption of precast slabs that could be moved into place quickly and permit traffic to be turned over the structure in the shortest possible time. In order to provide for easy handling, most deck slabs are comparatively short, and, of course, the shorter the slabs the greater is the number of transverse joints. These joints are a twofold source of trouble. Deflection of the supporting girders has the effect of closing the joints at the top of the slabs and opening them at the bottom. If the joints are square and the slabs are snug against each other, the flexing movement longitudinal with the girders induced by traffic causes the slabs to creep and open up at the joints. The other difficulty is waterproofing the deck over the joints.

A majority of the designs show beveled edges of the slabs so that, when the slabs are given a clearance of about ¼ in. on the girders, this allows a ¾-in. joint at the top of the slabs. The lower inch or so of the joint is calked with oakum and the joint is then filled to the top with an asphaltic preparation or cement mortar. The asphaltic joint is waterproof and also allows sufficient movement with the deflection of the girders to minimize the tendency of the slabs to creep. Anchorage of the slabs has been accomplished by riveting or bolting angle or plate clips to the ends of the girders to engage the end slabs. It is good practice to anchor the slabs to the steel girders longitudinally to prevent the opening up of the joints, even when they are filled as above described.

Since the tops of the top flanges of girders will normally present rivet heads and cover plates that do not extend the full length of the girders, it is obviously necessary to make some special provision to give the slabs an even bearing on the flanges, and most of the designs contain some provision for protection of the steel. This protection usually consists of sheet lead, formed over the rivet heads with a special tool, and a mortar bed thicker than the height of the rivet heads. One railroad uses wire mesh reinforcement in the mortar bed.

The slabs are usually handled by a locomotive crane, which progresses over the bridge on a track which is laid directly on the newly placed slabs. Where practicable, with double track, the cost and time of erection will be greatly reduced by taking one track out of service.

In most of the designs examined the waterproofing is limited to painting the top surface of the slabs with an asphaltic or tar paint. One road specifies coal tar, kerosene and cement for this purpose. Another road specifies the use of an integral waterproofing material in the body of the concrete. None of the plans examined requires a fabric or ply waterproofing.

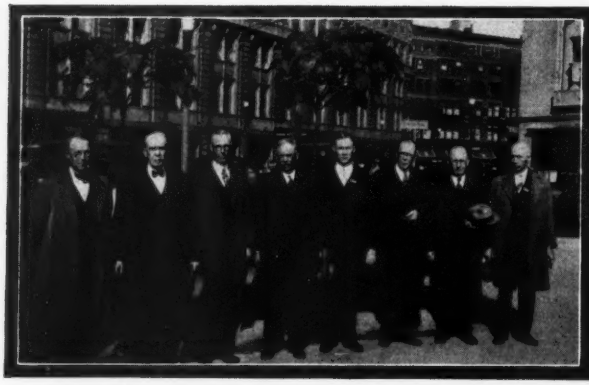
**Precast Slabs and Cross Girders Used by Kansas City Southern at Kansas City, Mo.**

A majority of the plans call for drainage from the center of the track to the side of the slabs. All of the designs show weepholes at the low points provided by the slope of the top surface of the slabs. These weepholes are usually provided with iron pipes protruding below the bottom of the slab to prevent the water from following the slabs to the steel. The ballast under the ties varies from 5 in. to 10 in., the average depth being about 7 in.

Concrete slabs for trestles are confined more or less to those roads traversing the Mississippi valley. Panel lengths vary from 14 to 18 ft., center to center of bents, for slabs placed on piling; in other words, the lengths approximate the height above ground. For greater heights or panel lengths, double pile bents or concrete piers are used.

A few roads, notably the Canadian National, have developed "T" beam slabs for spans up to nearly 30 ft. overall, which slabs generally have a width of 6 ft. 6 in. An interesting detail of these "T" beam slabs is the separate parapet sections, which are precast in 7-ft. lengths and dowelled to the main slabs.

Standard practice on most roads calls for slabs from 6 ft. 6 in. to 7 ft. 10 in. in width, or two per track, resulting in a joint under the center line of the track. In some cases these longitudinal joints are covered with 3/16-in. plates anchored to the slabs to prevent the ballast from working through. This same method is used for end joints



Some of the C. & O. Men

The C. & N. W. Is Always Well Represented

on one road, although generally the transverse joints over caps or piers are filled with a waterproofing material such as oakum, sand and pitch, or an asphalt mastic.

Anchor bents are generally provided at every fifth to eighth bent by using double pile bents, or a pier. Occasionally the slabs are doweled to the caps, or the slabs are sometimes tied together at the ends by reinforcing bars. Lifting hooks or stirrups are almost always provided and slabs are generally set on a mortar bed to give a uniform bearing. Some roads place zinc plates on top of the mortar bed and others put the zinc directly on the caps on alternate bents.

The most satisfactory results have been obtained when slabs are precast at a central yard where substantial platforms can be provided. This prevents warped or twisted slabs, which sometimes occur when slabs are built at the site on temporary foundations. The slabs can be hauled almost any distance on flat cars and are readily handled from cars direct to the final location in the bridge. Precast slabs of rectangular and "T" sections have been used on the Norfolk & Western on creosoted wooden double pile bents with precast concrete caps. Precast slabs were also used by the Wabash at Detroit on wood piles in rebuilding an approach to a car ferry landing apron.

A demand for the elevation of the tracks of the railroads over the arteries of heavy vehicular traffic created a demand for an economical and permanent type of over-crossing, and the precast reinforced concrete deck slab and cross-girder was developed. This type of subway floor soon became popular on account of the relatively small amount of noise resulting from the passage of traffic over it.

The platforms for the casting of the slab units, especially the roadway slabs, must be substantial. As a rule, they are constructed on 12-in. by 12-in. timber, spaced about 3 ft. center to center, laterally, and covered with 2-in. planking. The timbers are bedded on well-tamped soil and leveled carefully. The side and end forms are built of 2-in. planking, with studs spaced so as to maintain rigid lines to the sides and ends of the slabs.

The sides and ends of the slabs should be battered inward from the bottom up to give clearance for erection in place. The lower edges should be chamfered back about an inch to prevent ragged edges on the lower surface of the slabs. The upper surfaces of subway slabs should be so constructed that drainage can be obtained from the center line of the subway back to the parapet walls on either side.

The great majority of the subways of the precast unit slab type of deck are waterproofed by the use of several plies of felt and fabric, protected by a layer of asphalt mastic about 1½ in. in thickness, or by a covering of reinforced concrete about 2 in. in thickness.

The New York, Chicago & St. Louis has had considerable experience with slabs under railroad grade crossings. A slab crossing was placed in 1927 at Spriggsboro, Ind., at an angle of 37 deg. The slab is 10 ft. by 16 ft. 4 in. in plan and is 15 in. thick. Reinforcement is by means of ¾-in. round bars, spaced 10⅜ in. on centers in both the top and bottom of the slabs. There were 7.5 cu. yd. of concrete in the slab, and the estimated cost in place was $509, not including 6 in. of cinder backfill and ballast on top of the slab. Still another single-track crossing installed in 1925 at Lorain, Ohio, at practically a 90 deg. angle, is similar in design and construction, except that the slab is 10 ft. square. The cost of this slab in place was $302.

In 1927 the Great Northern constructed a two-unit concrete slab base under its crossing with the Northern Pacific at State Line Tower, Wis. Each slab is 8 ft. by 16 ft. in plan, for a crossing angle of 71 deg., and 16 in. thick. The cost was $24.81 per cu. yd. of concrete slab in place.

Reinforced concrete slabs 10 ft. by 12 ft. in plan and 12 in. thick are used under a double-track crossing of the Terminal Railroad Association of St. Louis and the Wabash at North Market street, St. Louis, Mo. The Chicago Great Western, on January 24, 1928, placed a precast concrete slab under its main line tracks at a crossing of the Missouri Pacific main line at Leavenworth, Kan.

A number of railways are now experimenting with precast reinforced concrete slabs in place of planks or other materials to carry traffic across tracks at important highway grade crossings. An average thickness of 5 in. appears to be most generally used.

The size of the slabs is determined more or less by the method of handling and placing. That is, the size should be such that the slabs will not be too heavy to handle and will fit the space to be filled. Usually the space between the rails is filled with two slabs, each about 2 ft. in width and about 6½ ft. in length. The edges or corners of the slabs should be protected with metal plates or curb bars to prevent wear or chipping. Some device should also be built into the slabs, as may be required for lifting and handling them with derricks. The cost of a 5-in. slab, including material and labor, will run about $0.75 to $1.25 per sq. ft., and the entire cost of a properly constructed slab crossing, including preparatory work on the track and roadbed, drainage and other items, will probably run from $1.50 to $2 per sq. ft. of the entire area covered. Good drainage is particularly essential to prevent, as far as possible, the heaving of the slabs during cold weather, as it is a costly job to remove and replace them.

Slabs may be placed directly on the track ties or they may be placed on a board filler resting on the ties. The latter method is preferable as a good bearing surface for the slabs is made possible, and a standard slab thickness may be used by varying the thickness of the board filler for variable rail heights. Openings of ¼ in. to 1 in. should be left between adjacent slabs and between the slabs and the ball of the rail, to be filled with pitch or mastic.

Committe: H. A. Gerst (G. N.), chairman; A. O. Ridgway (D. & R. G. W.), vice-chairman; Van S. Brokaw (C. M. St. P. & P.); A. C. Irwin (Port. Cement Assn.); G. C. McCue (C. N. R.); E. C. Neville (C. N. R.); C. A. J. Richards (Penna.); C. U. Smith (Harbor Terminal Director, Milwaukee, Wis.); G. E. Tebbetts (C. R. T. Co.); M. E. Thomas (C. & N. W.), and E. E. R. Tratman (Editor, Eng. News Record).

## Discussion

In discussing the handling of bridge slabs, E. C. Neville (C. N.) stated that his road builds some slabs and buys others, but that it is soon planned that all slabs shall be built at a central yard, as this practice is believed to be most economical. W. T. Krausch (C. B. & Q.) referred to the long-established use of concrete slabs on his road and stated that the use of precast concrete units in other forms is growing. He cited the number of abandoned foundations to be found on the average railroad as an indication of the advantage of a form of construction which in-

volves the use of transferable units. H. I. Benjamin (S. P.) opposed the use of concrete bridge slabs because of their weight, with their resulting high cost of installation and advocated the use of creosoted ballast deck construction as sufficiently permaent and more economical, particularly in cost of installation. He then emphasized the importance of proper manufacture of concrete slabs, particularly for smaller units such as crossing planks. He also referred to the use of concrete slabs under railway crossings, citing one installation where the foundation was so bad that it was necessary to support the slabs on piling. In another instance he reported that the cost of a concrete slab under a crossing had increased the life of the crossing itself from nine months to five or six years. Chairman Gerst emphasized the necessity of allowing adequate time for the curing of the concrete, stating that he had traced the deterioration of slabs in several instances to this cause. J. S. Ekey (B. & L. E.) described the placing recently of two single-track slabs, each 32 ft. long and 16 ft. wide and weighing 120 tons, with two wreckers. These slabs consisted of I-beams which were incased in concrete.

# The Wrecking and Salvaging of Railroad Buildings

By W. T. KRAUSCH
Engineer of Buildings, Chicago, Burlington & Quincy, Chicago

A CAREFUL survey of the facilities to be wrecked must be made by thoroughly competent men in order to determine the best, safest and most economical method of performing the work. The equipment and tools to be used, together with the methods, must be considered carefully in order to salvage the materials and equipment and to handle the rubbish to the best advantage. In some cases, it is possible to avoid rehandling by loading the material directly into cars or trucks; shipping the salvaged materials to the point where they are to be used, or to the storehouse; the scrap to the scrap dock, and the rubbish to a point previously arranged for.

## Salvaging the Materials

In some cases, salvaged materials such as lumber, pipes and fittings, heating, plumbing and electric fixtures, structural steel, window sash, doors and hardware, can be prepared ready for use and classified before shipment. The bricks salvaged should, if possible, be thoroughly cleaned so that they will be fit for use, when required on other work. The salvage on bricks depends, primarily, on the kind of mortar in which they were laid, and secondarily, on whether it is advisable to clean them at the site, at the point of use, or at the point of storage; this is an important matter because it involves rehandling not only the salvaged material but the rubbish as well in the latter two cases.

Before proceeding with the work, all pipe lines must be disconnected on the outside, properly protected and the lines rearranged or abandoned. It is customary to remove the plumbing, heating and lighting equipment, together with any elevators, sprinkler systems, boilers and machinery, prior to the wrecking of the structure itself in order to protect them from damage. It is also important, when the salvaged materials are to be used in the construction of another building, that plans or marking diagrams be prepared, in order to show clearly where the various parts and materials are to be used in the new structure and to assist in reassembling them in the new location with the least delay and expense.

If the salvaged material and equipment are to be placed in store stock, a complete detailed list must be furnished the store department and all other departments interested, indicating clearly the quantities, size and kinds of materials and equipments; in addition, proper credit must be ascertained in order that the accounting may be correct. In shipping materials into store stock, it is very important that a canvass be made of the prospective use of the various kinds of materials, so that, in shipping from the store stock, the matter of transportation cost may be taken into consideration. In handling the rubbish, it is always found that the bulk increases perceptibly and careful estimates must be made in order to determine definitely the manner of its disposal.

It is also very important to select the proper equipment for handling the salvaged materials and wreckage. In some cases, it is advisable to remove the brick from the walls directly into cars by means of chutes, using open-side and open-end cars in order that unloaders may drag the materials off the cars. At the present time, we have under contract the wrecking of a large structure, six stories in height, in which the bricks are being handled in this manner with the idea of working out the salvage after the cars are unloaded. In other cases it may not be worth while to clean the bricks and they may be used for filling at the point of use.

Wrecking and salvaging must be done under the immediate supervision of a competent foreman in charge of men familiar with the work. The hazards of wrecking are high, as is indicated by the insurance rate of about $19 per $100 for labor engaged in this work.

## How One Job Was Handled

In 1926, we moved one of our feed yards a distance of six miles across country. The old and new locations were connected by tracks and by good roads, which facilitated the transportation of materials. In this job, we dismantled and moved two large one-story sheep barns, each 133 ft. wide by 450 ft. long. These barns were quite old but the material was well preserved and in good condition. We also removed and salvaged the materials from a grain elevator, a hay barn, horse barns, a shearing shed and an office building, as well as unloading platforms, cattle chutes and other miscellaneous structures.

The facilities at the new location were enlarged to accommodate a 100 per cent increase in feeding capacity, which meant double-decking the barns in order to economize in space and construction. The first floors, or lower decks, of the new barns were designed so that the old barns could be rebuilt on top of these first floors with no change in the frames.

A wrecking crew was organized under the superintendent in charge of the construction of the new

facilities. A program was mapped out and a schedule made for the wrecking of the various buildings and the hauling of materials across country by trucks and teams, rather than in railroad cars. In the wrecking of the sheep barns, one at a time, the crew was divided into gangs of varying size, depending on the work assigned to each gang.

The electric current and water were shut off and all wiring, water piping, water troughs and feed pens were removed before starting the wrecking of the building. A small gang was assigned to the removal and crating of the window sash; a second gang removed the roofing materials; a third gang removed the roof sheathing and purlins, and a fourth gang followed, removing the siding and girts. All material was piled in an orderly manner, accessible for loading.

The roof trusses, girders and posts were properly marked and wrecked from one end, and the materials were piled so that they could be loaded in the order of erection at the new location, to which they were hauled by trucks and wagons. These were driven directly to the second floor of the new barn where the material was to be used. A large portion of the framing material was loaded on trailers, taken to the new site and set in place direct from the trailer, to save handling. The methods employed resulted in the salvaging of about 80 per cent of all of the lumber.

### Discussion

The discussion of this paper centered largely around the question of the relative economy of contracting the demolition of buildings to professional wreckers, as compared with the handling of this work by company forces. A. B. Scowden (B. & O.), cited an experience with a project of this character where the most careful estimates indicated that it would cost a railway $5,000 in excess of the value of materials salvaged to wreck a building with company forces. Bids were then solicited from wrecking contractors, one of whom offered $6,000 for the privilege. It has been his experience, Mr. Scowden said, that he could usually find a professional wrecker who could do the work better and more economically than a railway, primarily because of the better outlet he has for the disposition of salvaged materials. Mr. Krausch took issue with this conclusion, stating that his road has wrecked a number of buildings more economically than the work could be contracted for. He contended that there was no general rule, but that each job must be studied by itself.

# Emergency Bridge, Building and Water Service Work

A COMMITTEE report stressed the importance of close co-operation between the bridge and building department, the maintenance of way department and the operating department in emergencies involving railway structures, and the organization of forces to deal with such emergencies. It also called attention to the waste which may occur in the maintenance or neglect of emergency material stocks on the one hand, and to the delays to traffic occasioned by inadequate stocks on the other. The report follows in part:

With the present demand for the expeditious movement of traffic without interruption and without unnecessary expense, it is essential to organize in advance for emergencies so that they will be met in the most efficient, speedy and economical way. The committee feels that its report should cover emergency work brought about by storms, washouts, fires, derailments, etc., and should include an operating division, ordinarily approximating 500 miles of main-line track, under one operating head. It is assumed that a division organization can handle any ordinary emergency; that in cases of more severe damage it can call on adjoining divisions for assistance, and that in extreme cases, system forces, if available, can be called into service.

It is the duty of the supply department to be able to supply promptly equipment and material in sufficient quantities to meet emergency requirements. Emergency stocks should be centrally located so that they are available for immediate use at any point on the division. The proper size of such stocks depends upon the number and kind of structures for which replacements may be needed and other local conditions. Emergency material, after a certain length of time, should be used on regular maintenance work and replaced by new material, thereby preventing loss from deterioration. It is the practice on most railroads to replace all timber in either the first or second year, depending on local conditions and the kind of material.

Studies made by the American Railway Association and by the United States Department of Commerce disclose that it costs between 15 and 20 cents on every dollar of investment in material and supplies to carry these stocks. It is highly important, therefore, to keep emergency stocks at the minimum, which calls for close co-operation between the maintenance and supply departments.

Most emergency bridge and building work ordinarily can be handled by the regular division maintenance organization. Because of the similarity between bridge and building work, it is felt that gangs should be organized and equipped to handle both classes of work in emergencies. Exceptions to this practice are advisable, however, in the case of large terminals where there is an unusually large number of buildings. In such terminals, there should be separate gangs.

### Emergency Bridge Work

The bridge and building supervisor on a division usually has at least one combination derrick and pile driver and a gang with at least 12 men, a camp outfit and a standard list of tools. The pile driver and outfit cars of the pile driver gang should never be spurred out, but should always be placed on a track connected with the main line by a switch, so that the work train can pick them up quickly. Small gangs assigned to districts to take care of minor repairs to timber structures and responsible for structures in general should be equipped with motor cars, so that, in case of trouble, they can be assembled at the scene with the least possible delay.

Supplies of emergency bridge material should be at least of sufficient quantity to replace a 120-ft. timber trestle, in addition to riprap, blocking and other materials which might be needed in case of a washout or damage to bridges. Storekeepers usually have on hand or can quickly procure material for replacing buildings. In cases where it is exceptionally important to replace a structure promptly, it may sometimes be advisable to purchase materials locally, providing they can be obtained, but as a rule this need be done only in isolated instances.

The primary objective always is to restore service as quickly as possible. To avoid unnecessary delays, there must be close co-ordination between the chief dispatcher, the division engineer and the supervisor of bridges and buildings. It is of extreme importance to the operating department to know when the line will be safe for traffic and the supervisor, as quickly as he may be able to determine, should advise the dispatcher when he will permit trains to pass, so that the dispatcher in turn may arrange his schedules accordingly.

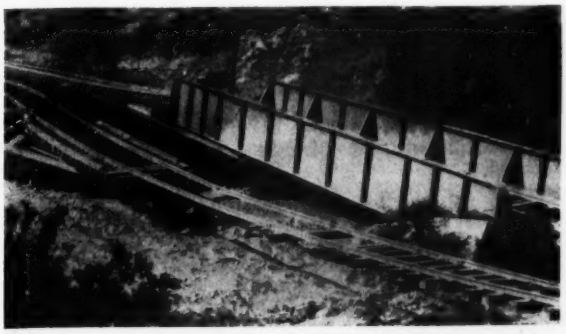
During periods of emergency, men are working under an unusual strain and for long periods at a time; consequently it is necessary that everything possible be done for their comfort. If possible, their outfits and camp cars should be near at hand so that, if there are sufficient men to divide into shifts, those not working may have proper rest. Hot coffee and food should be served at intervals in order to keep up the spirits and morale of the men, as there is nothing so discouraging as to work under adverse conditions on an empty stomach.

After restoring service, the next task is to complete the structure so that it will comply with the standards of the railroad. All excess material should then be loaded on cars and either returned to the storehouse or forwarded for use at some other point. All material unfit for further use should be burned or otherwise disposed of, leaving the premises neat and presentable.

### Water Service

Water service emergency problems are so different from those of bridges and buildings that it is usually advisable to maintain a separate organization for this class of work, under the direction of the supervisor of water service. He should have at least one division gang equipped with a camp outfit, motor car, tool car and all necessary equipment for the handling of ordinary repair jobs. In addition, he will ordinarily have repairmen at several points, and these men, in most cases, should be supplied with motor cars or automobiles. Co-ordination between the chief dispatcher, the division engineer and the supervisor of water service, is essential and should prevail the same as in the case of bridges and buildings.

In addition to the material carried by the division gang for running repairs, standard replacement materials should be carried in stock at the division storehouse. The stock of material to be kept on hand naturally depends on the size of the division to be served, the lineal feet of pipe lines, the number of tanks, pumps, water columns, etc. It should include a small amount of each kind and size of pipe in



**Emergencies Like This Call for Prompt Action**

service, split sleeve couplings for all sizes of pipe larger than 4-in., thereby doing away with pipe threading and calking and also the necessity for special tools, and one complete water column of each make and size used on the division, because different makes and sizes cannot be interchanged.

When oil is used for locomotive fuel it is advisable to keep duplicate pumps for important water and oil stations, so that in case of a breakdown all that is necessary is to unbolt the flanges, remove the pump and put in the reserve pump. In this way no pipe fitting is necessary, and no change in foundation is required. Duplicate parts for oil columns should also be kept on hand, especially the angle valves used in many oil columns. Where steam pumps are used, a reserve boiler, completely fitted up and ready to ship, should be held in reserve; also a pump with all necessary fittings to connect with any size line in service, should be available, particularly for outlying stations.

Tools should consist of the following: Cutting and threading tools for pipe ranging from ⅛ in. to 8 in. in dia., inclusive, with the necessary pipe wrenches and chain tongs, a blacksmith's outfit complete, drill press and drills up to and including 1 in., 1¼ in. bolt taps and dies, and an outfit for cutting and welding pipe and making up bends or branches on the work without the use of fittings.

Gangs should be provided with blocks and ½-in., ¾-in. and 1-in. tackle, a 2-ton chain hoist, hammers, axes, chisels for wood and iron, hand, hack and crosscut saws, peavies, lug hooks, augers, blow torches, lead melting furnaces and blow pots and the usual equipment of small tools. Two important instruments, which should also be provided, are an electric pipe locator and an electric leak locator, as great savings can be effected by these instruments. Another useful instrument is a dipping needle for locating curb boxes and dead ends of pipe lines. These instruments are costly, but frequently the saving attained on one job is more than sufficient to pay their cost.

### Conclusions

1. Emergency work should be handled by regular maintenance forces; in few cases is it necessary to maintain special emergency gangs.
2. Close co-operation between the using and supply departments is essential in order to have maximum protection at minimum cost.
3. Close co-operation between officers of the operating department, particularly the chief dispatcher and the maintenance officers responsible for emergency work, is necessary in order to restore traffic with the least possible delay.
4. Except in large terminals, bridge and building emergency measures should be consolidated.
5. Water service work should be handled by a separate organization trained and equipped for this class of work.

Committee: C. D. Turley (I. C.), chairman; H. I. Benjamin (S. P.), vice-chairman; W. M. Cardwell (Wash. Term.), F. M. Case (C. & N. W.), F. P. Farrell (M. P.), A. L. Gauthier (B. & M.), J. B. Livingston (St. L. S. W.), H. C. Munson (C. M. St. P. & P.), W. V. Parker (St. L. S. W.), R. E. Sheehan (C. B. & Q.), and M. G. Tribe (Erie).

### Discussion

Discussion on this subject brought out a number of interesting phases of emergency work and methods, and many instances were cited to illustrate the effectiveness of special organizations and other special preparedness measures. Dealing with the subject of organization, C. R. Knowles (I. C.) said, "The main thing is a good organization. So far as personnel is concerned, I feel that any special organization for emergency work will depend largely upon the spirit and morale of the regular maintenance organization." He then entered a plea for closer co-operation between different departments. C. W. Wright (L. I.) agreed that an emergency organization is desirable, but pointed out, that the maintenance of an adequate supply of materials for emergency work was of far greater importance. He said in part as follows: "On the Long Island, we can generally pick up men anywhere for temporary employment until regular emergency forces are rounded up, but the lack of an adequate supply of repair materials might hold us up seriously."

Commenting on the emergency equipment for the water service department, suggested by the committee, O. C. Anderson (S. P.) suggested the addition of a valve reseating machine, and in this he was upheld by W. A. Batey (U. P.). Both men cited instances where this tool proved most effective and economical in meeting emergencies on their roads.

H. A. Gerst (G. N.) suggested that it would be better to maintain sufficient emergency bridge material for replacing a 200-ft. timber trestle, instead of for replacing a 120-ft. structure as recommended by the committee. In reply, Chairman Turley pointed out that the committee's recommendation was based on the fact that material for replacing a 120-ft. structure comprised just two carloads, and on the further fact that it was felt that this amount of material was sufficient to keep emergency forces busy until other material could be secured.

Considerable discussion was aroused by the question whether emergency timber supplies should be treated. J. S. Huntoon (M. C.) suggested that all emergency stock should be creosoted as this would save the labor of rotating unused emergency materials from year to year, and would also prevent decay of the emergency timber supplies. H. I. Benjamin (S. P.) objected to creosoting, on the ground that it is usually necessary to cut material used in emergency repairs, thereby losing the value of the treatment. He said that objection to rotating emergency supplies can be accomplished effectively by close co-

operation with the stores department, and that little extra cost was necessary in this regard. A. B. Scowden (B. & O.) thought it best to have creosoted emergency timber supplies on those roads where most of the timber structures are of creosoted material, but suggested that on those roads where untreated timber structures are in service, it might be well to have emergency supplies of both treated and untreated timber.

While not specifically mentioned in the report, the advisability of having an emergency supply of sand bags on hand was discussed at length. The suggestion was made that it was advisable to retain a considerable supply of cement bags, but A. C. Irwin (Portland Cement Assn.) pointed out the disadvantage of this practice from the standpoint of both the railways and cement manufacturers. H. I. Benjamin (S. P.) stated that it was not their practice to keep a supply of cement bags, but that, on the other hand, they had standing orders with various cement companies whereby large quantities of cement bags could be obtained on short notice. Further discussion indicated that this was the best practice if cement bags are to be used. Mr. Scowden said that his road had given up the use of cement bags and for a long time has been using jute bags, and Chas. Ettinger (I. C.) stated that cotton bags were used extensively as sand containers in the Mississippi flood work of his road in 1927. He pointed out that these bags are cheaper than cement bags, and said that his road now keeps a large supply of them on hand, and uses them in the winter for distributing sand and sawdust for sidewalks and station platforms. Mr. Benjamin pointed out the effectiveness of wiring sand bags together with barbed wire so as to make them act more nearly as a unit. He said that this has proved particularly effective where water with heavy currents was encountered.

# The Control of Motor Cars to Prevent Accidents

A THOROUGH discussion of the care to be taken in the operation of motor cars was contained in a committee report, which also summarized the various points in a compilation of suggestions from which rules can be formulated to conform to conditions on any individual road. All phases of motor car operation were covered, but, owning to the length of the report, only a brief abstract can be given.

It is estimated that there are 55,000 motor cars in service on American railroads, representing an investment of between $11,000,000 and $12,000,000. Nearly $40,000 of these cars are used in maintenance of way work. Because of the fact that practically no physical effort is required in the operation of the car, the movements of gangs must be carefully scrutinized and gangs located in such a manner that motor car mileage is held to a minimum. Two distinct considerations enter into this: The loss of moving time, and the safety of the men while operating the motor cars.

One well known railroad has reduced the time of bridge and building gangs moving from point to point and to and from work 50 per cent by an intensive time study of their operations and the programming of their work, with the elimination of the haphazard handling of gang movements.

Each time a motor car is used, a potential opportunity is presented for accident or personal injury. To forestall accidents at the source requires that the motor car be properly equipped with safety devices, be dependable at all times, correctly and constantly maintained and be sensibly used.

The committee presents this compilation of rules and suggestions as derived from a study of the information furnished by 25 large railroads, not as a set of rules to govern each road in detail, but because each rule and suggestion carries essential value. From them can be formulated rules conforming to each road's individual conditions.

### Rules for All Employees Using Motor Cars

Track cars must not be used except on railroad business. They must not be used for personal purposes, except by special permission from the proper officer, and then only when accompanied by the foreman.

No persons, other than employees in the performance of their duties, will be permitted to ride on track cars without an order signed by the superintendent.

All operators of track cars must be examined on the rules; sight and hearing, should carry standard watches and be subject to time-service rules.

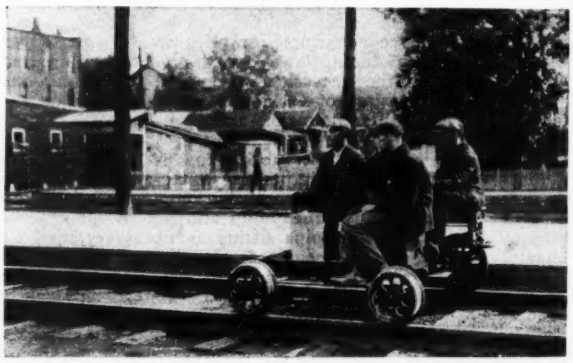
Operators of track cars should have copies of the current time table in their possession or on the motor car at all times.

Foremen and others in charge of track cars must, before starting on each trip, make a careful inspection to determine that the car is in condition for safe operation. Motor cars must not be operated unless equipped with safety rails, and front and rear tool guards. Immediately before starting, brakes must be tested to insure that they are in proper working condition. Do not use the brake suddenly without warning to all others on the car. Before starting, there should be a thorough understanding as to what part each person is to take if an emergency should arise, necessitating prompt handling of the car.

Cars should not be placed on or taken off the track with the motor running.

Before starting, see that the required flagging equipment is in its place on the car. A metal case should be provided for fusees and torpedoes. Flagging equipment should consist of two red flags, 12 or more torpedoes and 6 fusees by day, 2 red lights, 2 white lights, 12 or more torpedoes and 6 fusees by night. All flagging equipment must be kept in readiness for instant use. Lights must be displayed at both front and rear ends of motor cars at night.

All persons riding must be seated and the capacity of the car limited to the number of seats available. Trailers must be provided where the size of the gang prevents all from being seated on the motor car. No make-shift seats will be tolerated. No one shall be permitted to ride on a flat top push car.



**Motor Cars Must Be Operated Carefully Past Stations**

Men should be assigned to face both forward and backward to act as lookouts; no man should be permitted to sit where the operator's vision may be obscured. Material or tools should not be placed where there can be any possibility of fouling the brake lever or movable parts. Water kegs, track jacks and other tools or materials likely to derail the car, must be carried on the side or rear of the car. Special care must be given to bridge and lining bars to insure that they cannot fall from the car.

When pulling a push car behind a motor car, care should be exercised to fasten all material on the push car securely to avoid any part falling off which would be likely to derail following cars or trains. When necessary to operate two or more cars connected, rigid couplers must be provided.

Two Regular Attendants from the South | Six of the B. & O. Men | The B. & A. Delegation

Coupler pins must be of such type that there is no chance of their working out. The motor car must be in advance and other cars pulled, never pushed. Men must never sit with their feet between the motor car and trailer.

Cars must be run with great caution at all times, particularly at night and during foggy or severe weather. Every possible safeguard should surround the operation of motor cars at all times. When enroute to a washout or derailment, every precaution must be taken to ascertain its exact location and great care used in approaching the point of washout or derailment. In stormy weather or at night, where communication cannot be established with the dispatcher, the movement may be made under flag protection.

Each employee should feel his individual responsibility in the operation of motor cars; relief from this duty does not begin until the car has been taken from the track and locked securely or housed.

Constant lookout must be kept for chickens, dogs, or other animals or objects which are apt to be struck, whereby the car may be derailed, particularly at road crossings and in station grounds.

Cars must be run slowly when passing cars standing on an adjacent track, and a sharp lookout must be kept for persons who may step out from between such cars. Cars must not pass between a train and a platform at which passengers are being discharged or received, except where there is a fence between the tracks. On lines of more than one main track, cars must be stopped, and all men must dismount and stand clear of both tracks during the passage of a train on an adjacent track.

Motor cars, when operated where there is more than one main track, must be run with the current of traffic. General managers may specify certain locations where it is advisable to deviate from this rule on account of grades, curves, etc. A distance of at least 500 ft. should be maintained between a motor car and any other car or the rear end of a moving train. Certain districts may require a distance of 1,000 ft.

Motor, hand or push cars must not be fastened to the rear of trains and men must not be allowed, when on such cars, to hold to the rear of a train.

When two or more men are with a motor car, they should flag at all curves and cuts where the view is obstructed, or the side clearance is not sufficient to permit the car to be taken off. If the car is operated with only one man, he must proceed with extreme care, keeping a sharp lookout for trains and motor cars in both directions.

Heavily loaded track cars, which cannot be removed from the track promptly, must be protected in both directions by stop signals. Heavy material must not be carried on motor cars except in emergencies. Adjustments must not be made to a motor or a car while the car is moving, except that the carburetor may be adjusted, providing a sharp lookout is kept ahead and there is no accident hazard.

Employees must not get on moving track cars, except when it has been necessary to push them along the track to start them, in which case the pushing must be done only at the rear end of the car, after which those pushing may get on the car at the rear end only. When a direct-connected track motor car is coupled in front of a push car or any other track car not equipped with safety hand rails, it may be started by not more than one man on each side pushing on the hand rail of the front end of the car. Employees must not get off moving track cars except in emergencies.

Motor cars should not be run at a speed in excess of 15 miles per hour. Cars must not be run to exceed six miles per hour over frogs, switches, road crossings, track instruments, or through stations and interlockings. When approaching highway or street crossings at grade, cars must be under complete control before crossing. Unless an unobstructed view of at least 200 ft. can be had along the highway or street in both directions, cars must be brought to a complete stop. If the crossing is protected by a flagman, the operator must get a signal from him before proceeding.

When the rails are slippery on account of wet weather or frost, a greater distance is required to stop a car, and the man operating the car must take these conditions into account. A vehicle has the right to cross ahead of the motor car. When a motor car and a vehicle approach a crossing simultaneously, the motor car should stop and the vehicle be signaled to cross ahead of the motor car.

Cars must not be run through the spring rail side of frogs and they must come to a full stop before passing over interlocked derails or switches and be pushed by them. Switches must not be thrown for motor cars, but the cars shall be lifted over the points. Switches may be thrown for motor cars when pulling heavily loaded push cars, but only under the personal supervision of the foreman, and the switches must be returned immediately to their proper position and securely locked.

Torpedoes exploded by track cars must be replaced by the operator of the car or the flagman, the responsibility resting with the operator of the car. Cars must not be run on foreign lines unless authorized by proper officers of the home line and of the line over which the cars are to be operated.

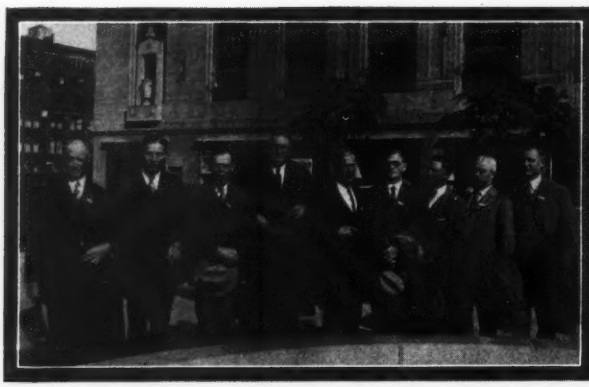
Persons in charge of motor cars will be required at all times to keep themselves informed as to train movements in the vicinity of their operations so as to avoid unnecessary hazards from running on short time ahead of trains, or in the face of traffic on single track territory. The foreman or operator must watch closely for signals carried by trains so as to know if additional sections are coming. Dispatchers will give lineups to foremen of gangs and other parties operating motor cars, when requested. Persons receiving this information must understand that they are given such lineups as a matter of information only and that these lineups do not relieve them of responsibility. They must protect themselves wherever and whenever necessary. Operating conditions may require the running of additional trains or light engines at any moment after the lineup has been given.

Motor cars should not be set off on public highways; neither should they be left with insufficent clearance, when removed from the rails. Leaving motor cars on the rails unattended is prohibited. Track cars must be set off the track while work is being done.

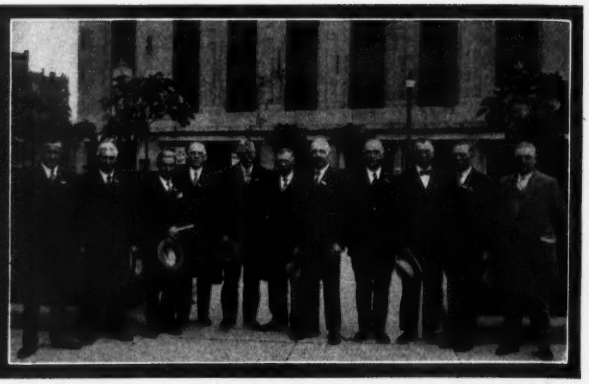
The use of fire for the purpose of heating the engine of a motor car in cold weather is prohibited; explosions may occur.

Engines must not be run in a closed car house, as carbon monoxide gas is fatal. Gasoline shall be handled only in the day time. Open lights of any description or smoking must not be permitted on or around the motor car or gasoline storage while tanks are being filled with gasoline. Cars must not be filled with gasoline while the engine is running. Cars must be shipped as seldom as possible. Fuel tanks must be thoroughly drained before shipment.

Excessive side play in bearings must not be allowed. Cars must not be used with any part worn or broken,



The Missouri Pacific Was Well Represented



Eleven of the 14 Canadian National Representatives

which is liable to cause an accident to the car or men.

Scuffling on motors or trailer cars is prohibited. Excessive or bulky clothing, such as will impair vision or hearing, should not be worn on motor cars. Turned-up overalls (unless stitched) and ragged or torn overclothes should not be worn.

Do not throw anything from a motor car without first looking to see that no one will be struck. Don't depend on someone else to look out for your safety. In using cars on double track, remember that trains are to be expected from either direction on both tracks.

Don't imagine that these safety rules apply only to someone else. They are intended for everyone.

Committee: W. A. Batey (U. P.), chairman; F. W. Hillman (C. & N. W.), vice-chairman; C. E. Brightwell (C. & O.); C. H. Collier (S. P.); Geo. M. Haley (U. P.); F. G. Hawken (D. S. S. & A.); M. D. Jones (Y. & M. V.); C. R. Knowles (I. C.); C. G. Lindstrom (C. M. St. P. & P.); A. V. Rohwelder (D. M. & N., and D. & I. R.), and F. J. Welch (C. M. St. P. & P.).

### Discussion

The extended discussion of this report indicated the intense interest of those present in the safety of motor car operation. H. I. Benjamin (S. P.) urged that supervisory officers be not permitted to operate a motor car alone, because of the impossibility of flagging around curves. He also recommended that motor cars be operated only by the foreman or assistant foreman, and that they should be brought to a stop at all highway crossings. In addition, he recommended that cars should be lifted over switches to avoid the possibility of leaving a switch open through carelessness. C. R. Knowles (I. C.) said that "An analysis of more than 300 motor car accidents over a three-year period, indicates that those resulting from collisions with automobiles were second only to collisions with trains, there being 43 of these accidents, or 14 per cent of the total. It is hardly conceivable that these highway crossing accidents would have occured if proper precautions had been observed. Further analysis of the causes leading up to the large number of accidents referred to, developed that in nearly every case it was the direct result of the violation of some rule." Continuing, he said, "I would like to emphasize the committee's recommendation that existing rules be rigidly enforced, and to point out that the time to enforce the rules is before the accident occurs."

The observation that a large percentage of motor car accidents occur to supervisory officers led C. J. Geyer (C. & O.), T. B. Turnbull (A. A.), P. Hofecker (L. V.) and others, to emphasize the importance of these officers practicing at all times in motor car operation the rules which they formulate for their men. They dealt pointedly with the subject of speed, and in this respect, Mr. Turnbull stated that the rules on his road call for 15 miles per hour but that many supervisory officers travel at higher speeds. This, he said, has a bad effect on foremen. Mr. Knowles made a suggestion, which met with general favor, to the effect that car operators, including officers, should not exceed a speed at any time which will prevent their stopping their cars within half the range of their vision. Much attention was given to the operation of cars by supervisory officers, because it was pointed out that a large percentage of the motor car accidents occuring are in connection with cars operated by these men. It was also impressed upon the meeting by many that the place to start in an attempt to reduce motor car accidents is with the supervisory officers.

General agreement was expressed with the committee's recommendation favoring soft iron brake shoes in preference to wood or leather brake lining. Both R. C. Henderson (B. & O.) and Mr. Turnbull stated that their roads had found soft iron brake shoes the most effective.

On the subject of line-ups for car operators, there was also general agreement, although it was pointed out repeatedly that car operators should not depend entirely on a line-up received, or reduce in any way their lookout for approaching trains. T. E. O'Brien (D. & H.) said that section foremen on his road are provided with portable telephones to enable them to communicate with operators at all times, and that the rules require all men to get line-ups from operators before putting a car on the track. Mr. O'Brien was insistent that motor car accidents can be reduced, and cited as an example the fact that there has been no accident to any of the eight motor cars in the bridge and building department of his road for three years. He attributed this good record, in part, to the practice of selling safety to the men, and said that each foreman on his road who goes six months without an accident is awarded a certificate signed by the division engineer. If a man has a no-accident record for a year, he is given a certificate signed by the engineer maintenance of way, and if he has a no-accident record for three years, he is awarded a certificate signed by the president.

Both J. S. Ekey (B. & L. E.) and Mr. Hofecker stated that all motor car operators on their roads are required to secure line-ups, and, while L. M. Bates (C. & N. W.) agreed that line-ups might be of value in some instances, he depreciated their value in general because of the fact that a line-up may be changed without notice. Mr. Benjamin agreed with Mr.

Bates, and said that although foremen on the Southern Pacific are required to secure line-ups, they are instructed not to depend on them solely. These line-ups, he said, are for their information only and do not relieve motor car operators of the necessity for taking proper precautions. The necessity for daily and periodic inspection of cars, and of carefully training and educating foremen and motor car inspectors in safety practices, was also stressed as of primary importance. Mr. Geyer emphasized the importance of supervisory officers operating safely, and recommended a practice, which he follows, of running around curves at slow speed, prepared to jump safely if necessary. He said that the C. & O. has a speed limit of 20 miles per hour for ordinary cars and 30 miles per hour for heavy cars. C. G. Lindstrom (C., M., St. P. & P.) urged that all cars should be equipped with free-running engines, and that they should be so geared that the greatest power can be secured at the lowest speed.

# The Operation and Maintenance of Water Stations

AN organization consisting of a system officer in charge of competent supervisors with gangs of skilled workmen, was recommended in a committee report dealing with the economical operation and maintenance of water stations. Attention was called to the importance of programming maintenance work and to the value of complete records for each station as an aid to the preparation of such programs. This report is abstracted below.

A suitable organization with definite responsibility for the proper understanding and performance of the various duties and assignments is of first importance in railway water supply work, where the immense distances and large territories eliminate the possibility of constant supervision. Co-ordination and co-operation with other departments, as well as the planning, systematizing and programming of departmental work, are necessary to the accomplishment of the best results. The definite assignment of a system officer to this work has well repaid those roads on which such organizations are in effect.

A reliable and experienced man should be assigned to each division, with definite responsibility for the general supervision of the water stations. A competent man in close touch with conditions should be in a position to offer constructive recommendations for improvements. He should be given sufficient office assistance to prevent the waste of his time in handling clerical work.

### Trained Supervision Is Necessary

Where pumping plants are provided with attendants, the operator is usually held responsible for the proper operation of the facilities and also for the minor repairs, which can be handled conveniently in connection with other duties. However, these positions are usually poorly paid and it is advisable, in most cases, to arrange for frequent checks of their work by a qualified mechanic. It has been found to be the best practice to assign definite territories to road mechanics or repairmen, with rates of pay sufficient to hold experienced and qualified men. These assigned territories usually include from 5 to 15 water stations, depending upon the importance, type and condition of the facilities, and the mechanic or repairman is held responsible for all running repairs of a mechanical nature, as well as for frequent detailed checks or inspections to insure proper attention and care by the operator. The instruction of the pumper in the economical handling of the equipment comes under the jurisdiction of these men, as well as the inspection and repair of gravity or automatic stations and city supply connections. These repair men should keep their supervisors advised of prospective heavy repairs in order that these may be handled by the division or system repair gangs.

Heavy maintenance work, such as tank, pumping equipment, or large pipe line renewals, can best be done by an experienced crew, equipped with suitable tools. On some systems, it is the practice to assign special water supply forces, consisting of a foreman, mechanics and laborers, with necessary camp cars and equipment to heavy divisions, while on others the heavy repairs are handled by the bridge and building forces in connection with their other duties. In emergencies, section forces or other available labor are sometimes used for this work, but with a properly planned and supervised system, emergencies will be infrequent and a considerable saving can be made by anticipating requirements and making the necessary provision beforehand. The use of experienced forces has been found to effect such economies on many railroads that, where there is not sufficient heavy repair work on one division to warrant the expense of such a force, system gangs have been organized to be assigned in accordance with a prearranged program and budget.

### The Programming of Heavy Work

A fundamental feature in the control of water supply maintenance expenditures is the proper programming of the heavy maintenance work. Any physical structure of unit of equipment in railway service is subject to such wear and deterioration that heavy repair or renewal is required at definite intervals, and arrangements must be made accordingly.

The funds for general railway maintenance work are limited on all railroads, and from them the conscientious and enthusiastic supervisor rarely feels that he has obtained his proper share for the facilities under his jurisdiction. However, this appropriation is prorated by the thoughtful management in such a manner as to accomplish the best results with the funds available, and a well considered and balanced annual program is necessary if the water service is to receive its share.

**Pumping Equipment Should Be Repaired by Skilled Workmen**

It is a common complaint that insufficient materials and supplies are allowed to protect the water supply requirements properly, but it is possible that, in many cases at least, this is largely the result of habit or over-anxiety. All progressive supply departments are now striving to maintain roadway material stocks at a minimum, consistent with safe operation, and they should receive the co-operation of the water supply forces to reduce the expense of unused material. It is well to hold a carefully considered stock of emergency material readily available to prevent possible water shortage and interruption to traffic, but this may easily get out of control without occasional check and ready information as to the actual amount on hand. A monthly or 60-day inventory of all material under the jurisdiction of the division supervisor has been found very helpful in keeping this information before the supervisor; it also permits transfer to other divisions if the stock becomes excessive.

On many railroads, operating supplies, such as oil, waste, small tools, etc., are delivered by monthly or bi-monthly supply train. This has proved very successful where the

**The Well-Kept Station Grounds at Battle Creek, Mich., Aroused Favorable Comment**

supervisor knows his requirements and either accompanies the supply train personally or has a dependable representative present.

In any business it is necessary to know definitely the kind and condition of facilities in use or available. The division supervisor and the general office should have detailed records of each water station, showing the type, condition, and location of structures and equipment, and the sizes and locations of pipe lines and valves. Without this information, plans for maintenance are seriously handicapped.

Before an intelligent recommendation can be made for improvements in operation, it is necessary that present and past costs be known as accurately as possible for both operation and maintenance. The water consumption and prospective requirements should also be a matter of record for future planning and comparison. Recommended forms for compiling this information are available in the proceedings of the American Railway Engineering Association, and the majority of the railway systems have some such cost records. Comparisons of the monthly summaries will indicate the general trend of business and traffic movements, and will frequently develop instances where economies may be effected by taking advantage of changed conditions. These statements also afford a valuable comparison of operating costs of the various types of power and pumping units and permit intelligent recommendation to be made for improvements involving charges to capital expenditures.

### Operation and Maintenance

Orderliness and cleanliness are of first importance in any type of railway water station. It may be possible to secure efficient results in a slovenly and ill-kept plant but the possibility is greatly in favor of the neat station.

Maintenance must be handled with a view of doing everything possible to prevent delays to train movement. The most satisfactory method appears to lie in a check of the facilities and equipment frequently enough to insure regular and uninterrupted service. Where duplicate or stand-by units are provided, these should be operated at such intervals as to make sure that dependable service can be expected when needed.

Water waste is frequently a source of great loss and its correction affords considerable opportunity for appreciable saving and economy. This is caused either by neglectful maintenance or through the carelessness by the using department. A check of the annual cost of these leaks, in the aggregate, is startling. When such a check is made by comparing the annual fuel consumption, which figure is readily available, with the water consumption reported, using the conservative estimate of one gallon per pound of water per pound of coal for making steam, and adding 25 per cent for other legitimate purposes, such as drinking water, boiler washing, coach cleaning, etc., a surprisingly large figure will still be unaccounted for.

Careful planning of maintenance work is essential. Forces must co-operate with the train dispatcher in order to arrange such a time for making repairs that trains will not be delayed on account of a shortage of water. Tanks must be cleaned and outlet rigging and water columns overhauled, but this can all be systematized to advantage. Care must be taken on the northern lines to have frost protection facilities carefully inspected and placed in suitable condition before cold weather. Fire protection facilities must be kept in a highly efficient condition at all times, and the station heating and plumbing facilities must be kept in good repair.

### Conclusion

The best of mechanical facilities will function only in a perfunctory manner or fail entirely if not followed up by a careful check system. It has been found that an organization, with a definite responsibility, is the first essential to the successful and economical operation and maintenance of the railway water station.

Committee: R. C. Bardwell (C. & O.), chairman; J. M. Fitzgerald (C. of G.), vice-chairman; F. M. Lehrman (C. & N. W.); A. L. McCloy (P. M.); W. E. Pierce (D. & H.), and H. H. Richardson (National Aluminate Sales Corp.).

## Discussion

The discussion of this report showed the convention in practically complete accord with the recommendations of the committee. The greater part of the discussion dealt with four principal subjects: The advantages of a separate water service department, the need for greater standardization of terms and equipment, the importance of a definite water service program, and the practice of metering. On the first of these subjects, a separate water service department, A. O. Bowers (H. V.) pointed out the special character of water service and outlined the reasons which brought about the separate water service department on his road. He said that up until four or five years ago, matters pertaining to water service on his road were handled by the bridge and building department, an arrangement through which no concerted attention was given to water service matters. He pointed out that they now have a separate water service department which is composed entirely of specialists on water service details.

O. C. Anderson (S. P.) and Chairman Bardwell stressed the necessity for men with special training in every branch of the water service department and pointed out how they are training men for water service work.

J. P. Canty (B. & M.), C. R. Knowles (I. C.) and Chairman Bardwell were among those who stressed the desirability of greater standardization of the names applied to water service equipment and of the titles of water service employees. Mr. Canty objected particularly to the many types of water columns used by the roads, and suggested that there was also an opportunity for standardization in a large amount of other water service equipment. Mr. Knowles, in

discussing the standardization of terms, thought it was highly undesirable to have a situation existing whereby there are several recognized terms for the same piece of equipment. As an example he pointed out the use of the terms penstock, water column, and standpipe, all of which are used to designate a single unit of equipment. As regards titles to water service employees, Mr. Knowles made the definite suggestion that road mechanics or repairmen assigned to definite districts, be termed "district repairmen," and that they should be made responsible for the operation and maintenance of all water service stations in their territory. Chairman Bardwell also stressed the economy possible by further standardization of tools and equipment, including pumps, boilers, pipe sizes, etc. Two important results of standardization were pointed out as reduced stocks and more efficient maintenance.

W. T. Krausch (C. B. & Q.) stressed the importance of making water service improvements with the view to effecting greater economies, and also the necessity for knowing that the greatest efficiency is being secured from existing equipment, while Mr. Knowles laid particular stress on the importance of a carefully prepared water service maintenance program. On this subject he said in part that "A general maintenance program should be made and followed each year, covering the usual running repairs and including all heavy repairs and renewals. It is not to be expected that a program of this kind will be followed to the letter. Its purpose is rather to serve as a "yardstick," from which the condition of the various water stations may be known at all times, and from which can be determined the repairs necessary to maintain them in a safe, economical operating condition."

A number of members discussed the metering of railway water supplies, from which it was evident that while this practice is not followed generally, most of those present favored it, particularly with the view of checking the efficiency of equipment, measuring losses in pipe lines and water containers, and reducing waste by the employees of using departments. Chairman Bardwell pointed out that purchased water is usually metered, and several cited the use of meters on their roads in connection with treating plants and at the points of greatest water consumption, such as roundhouses, boiler washing plants and stock yard facilities. It was the general opinion that there is a possibility for an unusually large saving in water a boiler washing plants. F. P. Farrell (M. P.) pointed out the large waste of water which usually occurs at stock yards and said that such waste was being prevented at one yard on his road through the installation of a master valve in the stock agents office.

# Manufacturers of B. & B. Materials and Equipment Present Exhibit

FIFTY-TWO manufacturers of bridge and building materials and supplies, associated with the Bridge and Building Supply Men's Association, presented exhibits during the convention. The exhibits attracted large attention, particularly because of the tendency for more companies to present full size equipment or practical working models of their various products.

The officers who served this association during the past year were as follows: President, F. M. Condit, Fairbanks, Morse & Co., Chicago; treasurer, D. A. Hultgren, Massey Concrete Products Corp., Chicago; secretary, W. D. Waugh, Detroit Graphite Co., St. Louis, Mo.; honorary directors: John E. Nelson, Joseph E. Nelson & Sons, Chicago, and B. J. Wilson, Pocket List of Railroad Officials, Chicago; members of executive committee: R. F. Repasz, William Robertson Co., Inc., Chicago; D. A. Evans, Kaustine Co., Inc., Perry, N. Y.; G. C. Mills, Zitterell-Mills Co., Webster City, Ia.; P. C. Jacobs, Johns-Manville Corp., Chicago; S. A. Baber, High Grade Manufacturing Co., Cleveland, O., and J. M. Rutherford, *Railway Engineering and Maintenance*, Chicago.

At the annual election of officers held on Thursday morning, the following were selected to serve for the ensuing year: President, D. A. Hultgren; vice-president, W. D. Waugh; secretary, I. B. Tanner, Joseph E. Nelson & Sons, Chicago; treasurer, B. J. Wilson; honorary director, F. M. Condit, Chicago; members of executive committee: W. G. Lawrence, Johns-Manville Corp., Chicago; C. H. McCormick, Ruberoid Co., New York; E. G. Whitmore, De Vilbiss Co., Toledo, O.; B. S. Spaulding, Fairbanks, Morse & Co., Chicago; S. A. Baber, and J. M. Rutherford.

A list of the companies exhibiting at the convention, together with the nature of their exhibits and the names of their representatives is as follows:

Aluminum Company of America, Pittsburgh, Pa.; literature and samples of aluminum paint; aluminum nails, aluminum shingles and aluminum dining car chairs; H. W. Ostrom.

American Hoist & Derrick Co., St. Paul, Minn.; literature and photographs of locomotive pile drivers and ditchers; H. W. Davis and Miss H. M. Hoeller.

American Railway Hydrant & Valve Company, Stapleton, S. I., N. Y.; hydrant cocks and valves; Wm. Volkhardt.

American Rolling Mill Company, Middletown, Ohio; samples and literature on Ingot Iron; H. M. Arrick and C. A. Kaiser.

American Tar Products Company, Pittsburgh, Pa.

American Valve & Meter Company, Cincinnati, Ohio; model of Poage style H water column with universal spout, and of Poage stock drencher; John T. McGarry, Dan J. Higgins and Cecil W. Stevens.

Byers Company, A. M., Pittsburgh, Pa.; literature and samples of Byers genuine wrought iron pipe; C. W. Damberg.

Carter Bloxoned Flooring Company, Kansas City, Mo.

Celotex Company, Chicago; display panels showing Celotex used as sheathing, as plaster base, under finished flooring as a sub-flooring, and roof insulation; E. E. Kelly.

Chicago Bridge & Iron Works, Chicago; literature and photographs of steel water tanks; H. C. Brown and A. A. Kenney.

Cullen-Friedstedt Company, Chicago; moving picture of steel Burro crane; Wm. C. Bamber.

Dearborn Chemical Company, Chicago; samples of chemically compounded rust preventive; C. A. Remsen and C. F. Barham.

Detroit Graphite Company, Detroit, Mich.; samples of metal protective paints; Robert Hintz and W. D. Waugh.

Detroit Steel Products Company, Detroit, Michigan.

DeVilbiss Company, Toledo, Ohio; paint spray equipment for bridges and buildings; E. G. Whitmore and G. N. Norris.

DeWalt Products Company, Leola, Pa.; exhibition of the DeWalt woodworker; W. Ross Stevens and W. A. Lamb.

Dickinson, Paul, Inc., Chicago; caboose jacks, cast iron chimneys, roof ventilators, deck and roof drains and cast iron exhaust heads; A. J. Filkins and A. E. Engman.

Dixon Crucible Company, Joseph, Jersey City, N. J; literature and samples of graphite paint and lubricants; H. A. Nealley.

Dunham Company, C. A., Chicago; specialties for low pressure steam heating systems; C. E. Roscoe.

Fairbanks, Morse & Company, Chicago; F. M. Condit, J. L. Jones, E. J. Coverdale, B. S. Spaulding and J. C. Flanagan.

Fairmont Railway Motors, Inc., Fairmont, Minn.; bridge and building gang motor car and motor car headlights; E. R. Mason, E. L. Clark, W. D. Brooks and C. F. Green.

Hastings Signal & Equipment Company, Boston, Mass.; tell-tale hanger and side clearance indicating device; Ross F. Hayes, R. W. Hastings, Harry H. Nayor and Benjamin B. Hastings.

High Grade Manufacturing Company, Cleveland, Ohio: literature and samples of fibre cement; S. A. Baber.

Ingersoll Rand Company, New York; literature on compressed air equipment for bridge and building work; W. H. Armstrong and L. B. Abrams.

ture on reinforced concrete culvert pipe, cribbing and piling; also photographs; David A. Hultgren and Charles Gilman

Metals Coating Company of America, Philadelphia, Pa.; samples and models showing the application of metal coatings; F. A. Barbey.

Murdock Manufacturing & Supply Company, Cincinnati, Ohio; hydrants, railway water service boxes, wall fountains and air valves; J. C. Endebrock.

National Lead Company, New York; literature on red and white lead; A. H. Sabin, F. E. Dodge, F. M. Hartley, Jr., and J. E. Hobbs.

Nelson & Sons, Joseph E., Chicago.

Nichols & Brother, George P., Chicago; duplex electrical control for turntables, and roller bearings for converting turntables to three-point bearings; H. E. Notley.

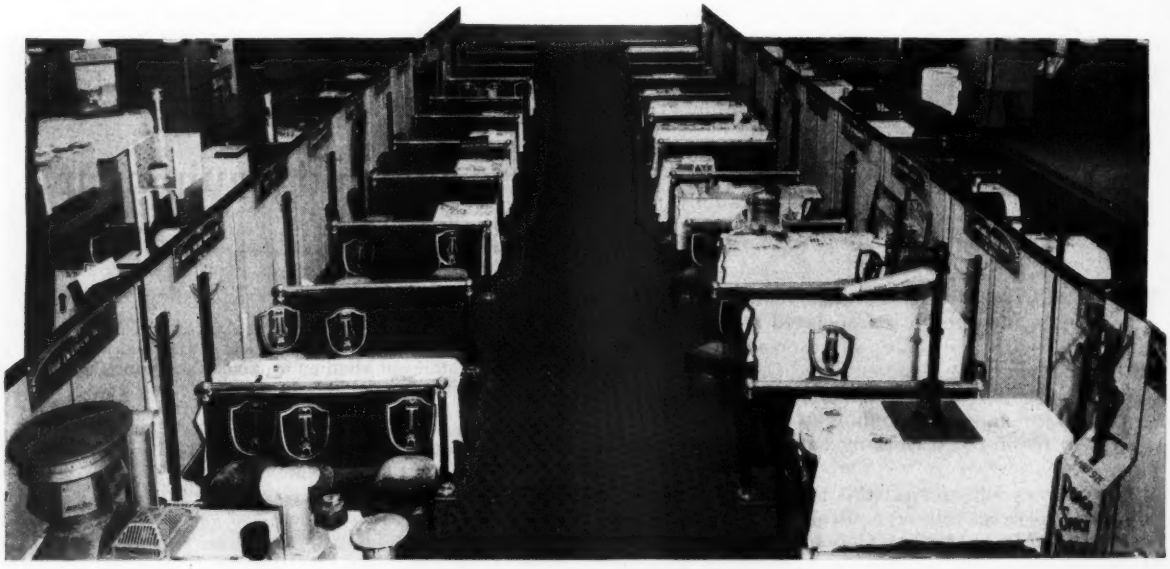
Northwestern Motor Company, Eau Claire, Wisconsin.

Patterson Company, W. W., Pittsburgh, Pa.; tackle blocks; W. W. Patterson, Jr.

Patterson-Sargent Company, Cleveland, Ohio; L. J. McComb.

Pittsburgh Des Moines Steel Company, Pittsburgh, Pa.; photographs and literature on steel water tanks and treating plants; J. A. Morley.

Pittsburgh Plate Glass Company, Paint & Varnish divi-



**A Part of the Exhibit of Bridge and Building Materials**

Ingot Iron Railway Products Company, Middletown, Ohio; model demonstrating the method of jacking culverts through embankments; A. W. Spaulding and W. R. Fraser.

Insulite Company, Chicago; samples of wood fibre insulation board and a model showing its application in building construction; Jack Frost.

Jennison-Wright Company, Toledo, Ohio; literature on creosoted timbers and flooring blocks; George L. Dresser and W. J. Clark.

Johns-Manville Corporation, New York; roofing materials, pipe and boiler insulation, waterproofing, industrial flooring and smoke jacks; R. P. Townsend, E. L. Colopy, C. D. Folsom and W. H. Lawrence.

Jones Paint Company, Rome, N. Y.; liquid and plastic roofing cement; A. de Wolfe Jones.

Kaustine Company, Inc., Perry, N. Y.; literature and models of chemical toilets and septic closets; Charles F. Smale and David A. Evans.

Lehon Company, Chicago; samples of asphalt roll roofing and asbestos shingles, waterproofing and roof coatings; Tom Lehon, J. W. Shoop and F. T. Carpenter.

Lewis Asphalt Engineering Corporation, New York; J. M. Roeschlaub.

Massey Concrete Products Corporation, Chicago; literasion, New York; paints, paint brushes and glass; John E. Leonard.

Pocket List of Railroad Officials, New York; copies of Pocket List of Railroad Officials; B. J. Wilson.

Robertson Company, H. H., Pittsburgh, Pa.; samples of protected metal roofing and siding, ventilators, skylights, sash and V-beam sheets; J. R. Sexton and N. S. Morris.

Robertson & Co., William, Chicago; literature on cinder conveyors, and sand dryers, also model of Jiffy high-pressure lubricator; R. F. Repasz.

Ruberoid Company, New York.

Sherwin-Williams Company, Cleveland, Ohio; literature on metal protecting paints; H. A. Sturn.

Simmons-Boardman Publishing Company, New York; copies of *Railway Age* and *Railway Engineering and Maintenance;* Elmer T. Howson, F. C. Koch, N. D. Howard and R. E. Thayer.

Spraco Painting Equipment Company, Somerville, Mass.; paint spraying equipment; Frank G. Dennison and Frank A. Tredinnick.

U. S. Wind Engine & Pump Company, Batavia, Ill.; literature on tanks, steel towers, water columns and tank fixtures; also models; C. E. Ward.

Zitterell Mills Company, Webster City, Iowa.

# What's the Answer?

***What Our Readers Have to Say on Current Questions That Perplex Those Engaged in Maintaining Tracks, Structures and Water Supply Facilities***

**QUESTIONS TO BE ANSWERED IN THE JANUARY ISSUE**

1. *What is the best method of constructing a French drain so that it will remain effective the longest possible time?*

2. *What special precautions should be taken in painting steel bridges in cold weather?*

3. *When track has been cribbed up to carry it over a washout, how far is one warranted in going to remove this cribbing as filling is placed?*

4. *For what conditions should one look particularly when making an inspection of roofing?*

5. *When heavier power is placed in service on lines laid with light rails, what special attention should be given to track maintenance?*

6. *To what extent can water service supplies and equipment be standardized?*

7. *What is the best method of widening embankments in prairie country where the height of the embankment does not exceed five feet?*

8. *What are the relative merits of the locomotive crane and the ordinary "derrick car" for bridge maintenance work?*

## Injury to Ties by Tamping

*To what extent are the bottoms of ties, particularly those of soft woods, damaged by tamping? What practical means can be used to prevent this damage?*

### Clean Out Ballast to Bottom of Ties

By John Anderson
Section Foreman, Oregon Short Line, Pocatello, Idaho

The writer has only had experience with gravel ballasted track, and zinc treated sawed fir ties. This ballast, which is pit gravel, is quite clean, and the aggregates range in size from as small as peas to two inches in diameter, mixed with a small part of coarse sand. Shovel tamping out of face, with a raise of from two inches to four inches, has not damaged the bottoms of the ties, according to inspections made by the writer.

When surfacing low spots and small imperfections in track with tamping bars, the writer is unable to see how the bottoms of ties can be damaged if the ballast is cleaned out to their level and the face of the tamping bar is driven under the tie. This is a matter of instruction and supervision for the foreman to attend to. The writer has seen laborers who tried to tamp ties with a tamping bar, and who did not clean out the gravel within an inch or more of the bottom of the tie. Such work was not only an absolute waste of time, but the side of the tie near the bottom was bruised and battered, and furnished an opportunity for decay to get started. The width of the face of the tamping bar can be anywhere from ½ in. to ¾ in. and give good results, but the ballast must be cleaned out to the bottom of the ties and enough below to correspond with the face of the tamping bar so that the bar goes under and not against the side of the tie. The writer has taken out zinc-treated sawed fir joint ties after 15 to 20 years service where the fibre on the face of the ties was soft and pulpy to a depth of two inches to three inches and the spike holes were rotted out, while the bottom of the tie was hard and solid and showed no damage from tamping, although joint ties are tamped harder and oftener than other ties.

My experience is that this is a problem of supervising and instructing laborers how to clean out the ballast before tamping, and to tamp under and not against the side or edge of the bottom of the ties. This prevents injury and is the only way to tamp so that the track will stay after it has been raised.

### Injury Is in Direct Proportion to Care Used in Tamping

By Roadmaster

The extent to which ties are injured by tamping is in direct proportion to the care that is used in the work. The injury is caused by striking the lower corners of the ties with the tamping bar or pick, or by driving the ballast against these corners instead of under the ties, and is most apt to occur with stone ballast, both because this kind of ballast is harder to remove from between the ties when preparing for the work and also because the sharp edges of the stone have a greater cutting effect on the wood.

In tamping ties, the only work which is effective is

that which drives the ballast under the ties and compacts it there; thus, any blows which strike the ties or drive the ballast against their sides result in wasted effort and increase the cost of the work. If this were the only result, it would be bad enough, but often the injury to the ties is of even greater importance, for several reasons. The bruising and wearing away of the fibres of the wood hastens the start of decay, whether the ties are treated or untreated, although decay sets in more rapidly, of course, with the latter. In addition, the cutting away of the corners of the ties, where it is most apt to occur from improper tamping, reduces their effective bearing area by the rounding of the outer edges of the bottom surface.

To prevent this injury, it is necessary to clean out the ballast in the cribs almost to the bottoms of the ties and then to see that the ballast is driven under the tie without allowing the tamping bar or ballast to strike the sides or lower edges of the tie. This is largely a matter of instruction and supervision, and should be followed up closely, since improper tamping is not only a waste of labor, but results in waste of material as well.

## Replacing Piles in Ballast-Deck Trestles

*What is the most economical method of replacing an individual pile in a bent of a ballast-deck trestle?*

### Replace with Post on Old Pile

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

Until such time as two or more piles of a bent require redriving, it is most economical and entirely practicable to renew an individual pile by cutting it off at a point from 12 to 18 in. below the surface of the ground, where it is almost invariably found to be perfectly sound and replacing it with a timber post. In some cases, an extra cross brace may then be found desirable to compensate for any decrease in lateral stiffness due to the removal of the pile.

After two defective piles in the same bent have been replaced in this way, and as soon as weakness develops in the remaining piles, it may be found advisable to cut off all of the piles down at the point where they are sound and drift a mud sill into place on which a frame bent may then be set. In this way a bridge of this type may be carried along in perfectly safe condition for a number of years, or until such time as complete replacement of the structure is necessary.

This practice also applies just as effectively to the ordinary pile trestle bridge, although the expense due to disturbance of the deck in order to get a pile in place would not be so much in this case. The redriving of a pile trestle is not justified until at least 50 per cent of the piles are defective, and, in the interval, the practice of substituting posts for defective piles in some places and frame bents elsewhere is fully justified, for it will decrease the maintenance cost materially without any sacrifice of strength.

### Driving a Single Pile for a Ballast-Deck Trestle Is Expensive

By Supervisor of Bridges

The construction of a ballast-deck trestle makes it a costly matter to remove enough of the deck to allow the driving of a single pile in a bent to replace one which has become damaged in any way. For this reason it is usually better to cut off the damaged pile and set a post on it, as is often done in the case of open-deck trestles. Where the ballast-deck trestle is built with treated piles, as is usually the case, the post should also be of treated material, so that it will not have to be renewed before the normal life of the piles has expired.

The value of "nursing along" pile trestles until the whole structure must be renewed is well understood, and is greater with ballast-deck trestles than with the open-deck type, owing to the greater amount of work required to prepare for driving piles in structures of the former type.

## Keeping Suction Lines Free of Ice

*What is the best method of preventing the clogging of intakes of suction lines with ice?*

### Design of Intake Is Important

By E. M. Grime
Engineer of Water Service, Northern Pacific, St. Paul, Minn.

Trouble of this kind is usually the result of lack of a proper plan or else the installation of a makeshift arrangement when the plant is first built. Suction line intake arrangements in lakes, reservoirs, or streams are among the most interesting problems confronting those responsible for reliable water supply, and so much depends on their location and other details that almost every case requires individual design if trouble from ice or other debris is to be avoided.

Where the supply is from a lake or reservoir, the problem is usually simple, and if the pipe is laid so as to be well below the lowest water level or the ice line and sufficiently above the bottom to avoid drawing mud into the line, there should be no trouble. It is desirable to have a box over the end of the pipe, covered with netting which will keep out fish, ice, or floating debris. Some successful reservoir intake lines are protected by covering the end of the pipe with a pile of riprap that acts as a filter.

When the water is taken from a shallow stream, to avoid drawing in small particles of ice or other debris, the essential consideration is to provide means whereby the water may enter the line at a velocity so low that all floating material will be carried by instead of collecting around the intake opening. Usually, this can be accomplished by setting a perforated wooden box of suitable dimensions below the bed of the stream and covering this on all sides with a layer of gravel which will act as a filter. The intake pipe drawing from this box creates practically no disturbance to the stream flow. In the case of a shallow stream with a solid rock bed where trouble is experienced with frazil or anchor ice, a trench several feet wide and as deep may be blasted out, and after a perforated box or pipe of approximately twice the diameter of the suction line has been laid in the bottom of this trench, it is backfilled with the excavated rock. This type of ice formation accumulates where the velocity is high and the temperature very low. By providing this understream reservoir, the slight increase in temperature from the earth and the low velocity tend to prevent ice particles from accumulating in the suction line.

As an added precaution, it is usually advisable to use a gravity intake line, instead of a direct suction line, connecting with a suction well. There should be sufficient fall to the intake line so that any debris entering it will be carried to the well, while suitable provision

should be made for cleaning the well. A by-pass arrangement should also be provided so that pump pressure may be used to flush out the gravity line.

### Intake Boxes Should Be Provided

By Supervisor of Water Service

Most trouble with ice in suction lines occurs where the intake is located in shallow streams, without sufficient protection for the end of the pipe. In such cases an intake box should be built around the end of the pipe, with provision for the entrance of the water, either by means of narrow slits or holes bored in the sides of the box. These intake boxes must be built strongly and be well anchored to the bottom to withstand the pressure of floating ice or drift. They are sometimes further strengthened by piling coarse riprap around all sides, thus permitting water to enter the intake while acting as a screen to prevent ice or other material from clogging the aperture through which the water enters the intake box. Such intakes are relatively expensive but are well justified where trouble is experienced with ice as an insurance against interruption to the service.

## Oiling Slide Plates of Switches

*Are there any advantages in, or objections to, the use of oil on slide plates of switches and spring rail frogs? What type of oil is best for this purpose?*

### Should Be Oiled to Protect Plates

By C. W. Baldridge

Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

The practice of oiling slide plates is general where the maintenance employees can be prevailed upon to do the oiling. There is no reason that I know of why slide plates should not be oiled, as the use of oil makes the throwing of the switch easier, and protects the plates from rust and wear. A cheap grade of black oil is most commonly used for the purpose.

It is sometimes claimed that oil on slide plates collects and holds sand and grit and thus causes greater wear than would occur without oil. I have never seen such a case, nor have I any knowledge of slide plates which were kept oiled wearing out before the rails with which they were installed were worn out.

### The Advantages Outweigh the Disadvantages

By Supervisor of Track

While there is some difference of opinion as to the advisability of oiling the slide plates of switches and spring rail frogs, it has always been my custom to do so, as there seem to be several advantages in the practice, with almost no disadvantages. There is no question but that lubricating the slide plates of either switches or spring rail frogs will allow the points or spring rails to slide over the plates easier than where oil is not used, especially on turnouts which are used at rather infrequent intervals. It is sometimes necessary to throw switches in a hurry and in such cases the use of oil is a distinct help. It also aids the spring rail of a frog to return to its proper position after a train has passed from the main track to a siding.

The only disadvantage in the use of oil on slide plates is that it sometimes collects sand or cinders. When this occurs the old oil can be removed from the plates quickly with a piece of waste and new oil applied. The oil used can be almost any grade of cheap oil, and the familiar "black oil" is common. The oil should not be too thin and should not be applied too heavily, especially in cold weather. The cost for either labor or material is small and the results are well worth the expense.

## Preparing for Snow Plows

*What measures should be taken at the approach of winter to prepare for the operation of flangers and snow plows?*

### Preparations Should Begin in the Spring

By R. G. Kenly

Chief Engineer, Minneapolis & St. Louis, Minneapolis, Minn.

Work reports should be in the hands of the mechanical department in the early spring for the rehabilitation of all snow fighting rolling equipment, and a check should be made in the early fall to know that this has been done. Rotary snow plows should be tested to insure that the machinery is ready for use. The roadway department should check all clearances for the operation of plows; portable snow fences should be put in place and flanger signs set up wherever missing; the planks in farm crossings which will not be used during the winter should be removed; section forces should be supplied with suitable brooms, and, in outlying territory where winter maintenance forces are limited, a shovel and a broom should be placed at each main line switch, or group of switches, where they are close together. A supply of coarse salt should be available where its use is permitted at switches and frogs.

Probably the most important detail is that men acquainted with the snow-fighting equipment and fitted by previous experience to secure the best results should be available. The road foreman of engines, a trainmaster or assistant, and a track supervisor should accompany the rotary snow plow or work trains sent out with plows at times when the road is blocked.

The management should determine what particular heavy traffic lines must be kept open in blizzards, and what less important lines had better be tied up until heavy snow and wind storms subside. It is worse than useless to attempt to open prairie lines when the winds are so strong as to fill the snow cuts immediately after they have been opened, for equipment is likely to be marooned and its usefulness lost in digging it out.

The value of special movements of flanger cars after the snow becomes deep and packed along the railroad is doubtful, particularly as to the matter of expense and flanging by hand where necessary in cuts and elsewhere may be less expensive and more effective. In other words, it may be better to put the cost of running a flanger train into more track labor and to do the job by hand.

### Special Attention Should Be Given to Highway Crossings

By Supervisor

On lines on which snow plows and flangers are to be operated, the section gangs should go over all road crossings in the fall before freezing weather and see that they are put in good condition for winter. This applies particularly to plank crossings, in which all planks which show any tendency to looseness should be spiked down firmly, since heaving will often loosen planks which would hold all right during ordinary open weather. Flanger signs should be checked up to see that none are missing where they are needed. If portable snow fences are used, they should be set in

place before the ground freezes, both to save labor and to be sure that they will be anchored firmly in the ground, since it is difficult to do this when the ground is frozen. All cinders, ballast or other materials should be cleaned off of the track to the level of the top of ties and the ditches should be cleaned out.

## Removing Ice Near Bridges

*When explosives are used to break up heavy ice adjacent to bridges, how should the work be done to obtain the best results?*

### Explosives Must Be Used with Caution

By Superintendent of Construction

While dynamite is effective in breaking heavy ice, it must be used with caution near bridges to avoid damage to the structure, and the charges must be lighter than could be used to good effect if the bridge did not have to be taken into account.

If the ice is gorged deeply against a trestle or small opening, about the only thing that can be done is to use explosives in as large charges as is consistent with safety, breaking up the ice sufficiently to let it pass through. This is slow work, but an attempt to hurry it by increasing the charges to too great an extent is apt to cause trouble.

If the ice is not heavily gorged or consists of a thick sheet which it is desired to break up, a method suggested by B. F. Gehr, assistant master carpenter on the Cincinnati division of the Pennsylvania, in the May, 1919, issue of *Railway Engineering and Maintenance* may be employed. This consists of a pile-driver drop hammer attached to the lead line of a track crane with a boom 40 ft. long, the hammer being raised and allowed to fall on the ice. This method is said to be both rapid and economical, since many blows can be delivered in a short time and only a small force of men is necessary.

## Care of Switch Lamps

*What measures should be taken to insure the proper functioning of switch lamps at all times?*

### A Number of Precautions Must Be Taken

By J. B. Wilson
Section Foreman, Missouri-Kansas-Texas, Denison, Tex.

The oil should be of a good grade and should be kept in a clean container. If possible a different funnel should be used than for other oils, since mixing different kinds of oil reduces their efficiency. The container should be kept tightly closed except when oil is being put into it or taken from it, not only to prevent evaporation but also to prevent the entrance of dust and other dirt. The presence of water in the oil can be detected by removing the burner and wick and holding a lighted match to the lower end of the wick. If there is water in the oil, the wick will sputter but not burn.

The oil fount should be emptied and cleaned at intervals, and the wick should be cleaned at the same time by washing it in the same kind of oil that is used in the lamp. The color of the flame or the odor of the oil will indicate when this should be done, which is usually about once a month for mineral oils and somewhat oftener for fatty oils. The fount should not be filled nearer than one-half inch of the top in order to leave room for the oil to expand. If filled to the top, it will cause the oil to overflow and the lamp to smoke, giving a poor light and dirtying the lamp.

In lighting the lamp the wick should be turned as low as possible without putting out the flame, as the height of the flame increases with the heat. After a few minutes the wick can be turned up the proper amount to give the desired flame. The ventilation of the lamp should not be allowed to become clogged, thus preventing the escape of the gases.

The lamp should be kept vertical and focused properly. The headblock should be well tamped to prevent excessive vibration from passing trains and, if this is not sufficient, a little waste or excelsior should be placed under the fount to act as a shock absorber.

### Systematic Care Is Essential

By Supervisor

To secure the best results from switch lamps, it is necessary not only to take proper care of the lamp itself, but also to see that, when the lamp is in position on the switch, the light can be seen by an approaching train at the greatest possible distance.

Assuming that the switch lamp is properly designed to furnish ventilation to permit the escape of the heated air and gases and to allow the entrance of the proper amount of fresh air to support combustion without causing drafts or "fogging" of the lenses, the care of switch lamps is a simple matter, but one which, at the same time, requires close attention. Most of the troubles with the lamps are caused by smoking, causing a deposit of soot on the lenses and blocking the ventilation in the lamp, which will rapidly make matters worse in this respect.

Smoking may be due to several causes, among which are a poor quality of oil, improper ventilation, carelessness in the care of the burner or the wick, or turning the wick too high when the lamp is lighted. To avoid these troubles, the inside of the lamp should be inspected at intervals and cleaned whenever necessary, paying special attention to the vents, which sometimes become stopped up by insects attracted by the light, as well as by the deposit of soot. Burners should be thoroughly cleaned by boiling at intervals and the wicks should be trimmed as they become charred. In filling the oil fount, a space of about ½ in. should be left at the top, otherwise the oil is apt to overflow the fount as it becomes heated, clogging the burner and causing a "messy" condition in the interior of the case. When the wick is lighted, it should be allowed to burn for a few minutes and then should be regulated to produce a flame without smoke. The lenses should be kept clean by wiping with dry, soft waste.

Where long-time burners are used, it is necessary to fill the lamps only about once a week and this is usually often enough to attend to the other details. The section foreman should watch the performance of his lamps whenever opportunity offers, and the supervisor or roadmaster should also watch them when passing over the road after dark, since the section foreman can do this only in a limited way. The care of the lamps should be delegated to one man in the gang and he should be instructed as to the various points to be looked after.

To insure that the lamp will give the proper indication to the enginemen, the lamp must be vertical and placed so that the face of the lens will be at right angles to the track. The head block must be tamped solidly to prevent jarring the lamp, and, in some cases, it is advisable to place a coiled spring or a wad of waste under the oil fount to lessen the vibration. Many, if not most,

roads require the enginemen to report all cases where main-track switch lamps are out or do not give clear indications during the night and all such reports should be followed up promptly so that proper attention may be given to the lamp or switch stand to correct whatever defect may exist. The importance of the proper functioning of main-track switch stands is so great that no chances should be taken.

## Finish for Station Floors

*What is the best finish for wooden floors in passenger stations, from the standpoints of protection to the floor, maintenance of the finish and appearance?*

### Care Must Be Given Floors in Service

By Engineer of Buildings

The finish to be used on wooden floors in passenger stations depends on the kind of wood used for flooring and the importance of its appearance. In the cheaper and smaller stations, where appearance is considered of little vallue, yellow pine flooring, with no finish of any kind, is often used. In the better classes of stations hardwood flooring, such as maple or oak, is often used and, unless there is some reason for staining the wood to harmonize with the treatment of the walls and doors, it is finished in the natural colors, either with a floor varnish or wax. The latter is well adapted to station floors since it can be renewed easily when necessary.

In cleaning varnished hardwood floors, the janitors should be cautioned not to use strong solutions which will injure or remove the varnish, and should be watched to see that they obey these instructions, for carelessness in this regard will soon spoil a good job. When floors have once been finished and taken care of properly, they can be maintained in good condition and can be refinished easily, when necessary, if given attention at the proper time.

### Varies with the Kind of Flooring

By C. E. Ettinger

Supervisor Bridges and Buildings, Illinois Central, Chicago

It must first be understood what kind of wooden flooring is proposed to be finished. If maple is to be left in the natural color, it should be given one coat of shellac after it has been sandpapered. After properly drying for a few hours, it should again be sandpapered with No. 00 sandpaper, followed by two coats of a high-grade floor varnish. This will not darken the maple and the finish will, with proper usage, wear for some time.

It must be borne in mind, however, that floors finished in this manner should not be scrubbed with strong lye water, as this will dissolve the coatings and ruin the floor. Floors can be cleaned and repolished by using any one of a number of inexpensive floor polishes. Maple floors are often oiled with reduced boiled linseed oil, which darkens the wood to a great extent, and is of little benefit, as maple is very close-grained and hard, and has very little absorption. This causes the oil to lie on top of the flooring where it remains tacky and so holds all dirt, soon giving the floor a dirty appearance.

When a darker finish is required for yellow pine flooring, it can be stained the desired shade and given a coat of orange shellac, followed by two coats of floor varnish, as specified for the maple flooring. If a natural finish is desired, the stain should be omitted. Such floors should be cleaned in the same manner as maple.

Ordinary pine floors, which cannot be finished in the natural color, should be painted to correspond with the trim or other architectural features of the room. A first coat, consisting of a white lead base properly colored and reduced with 75 per cent of linseed oil and 25 per cent of turpentine, should be applied, followed by a second coat with the same base and reduced with 25 per cent of linseed oil and 75 per cent of turpentine. The floor should then be painted with two coats of a high-grade floor paint of the proper shade. Each coat should be sandpapered after it has dried thoroughly. Although oil paints are sometimes used on floors, their use is not recommended, as they are not sufficiently hard, are pliable when dry, and soon wear off.

With proper care and janitor service, floors finished in the manner described will wear for long periods of time and retain a good appearance, while refinishing can be done at nominal expense.

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## Fatal Accident Due to Washout

EARLY on the morning of July 20, a Wabash freight train was wrecked on a trestle bridge near Mineola, Iowa, resulting in the death of the engineman and fireman on each of two locomotives. This trestle, according to the report of the Bureau of Safety of the Interstate Commerce Commission, is 216 ft. long and originally had 15 bents, each containing four piles, but during the last three years, 11 of the bents were sawed off at or near the ground line and replaced by frame bents which were secured to the pile stubs by drift bolts. These frame bents were braced longitudinally as well as transversely by diagonal bracing. This bridge collapsed under the freight train, causing the two engines and several cars to drop into the stream.

The conductor testified that it had been raining for several hours before the accident, while the two brakemen estimated the depth of water in the stream at 8 to 10 ft. when they examined the wreck. The conductor of a train which crossed the bridge about an hour and a half earlier, said that although it was raining when his train crossed this bridge, he saw, by a flash of lightning, that the water was two or three feet deep and observed nothing to indicate any trouble.

The section foreman stated that when it started to storm, he had called his gang and was patrolling the track and bridges, but as he had only three men and there were six bridges on his section, he was compelled to limit patrolling to the bridges that, in his experience, were more subject to high water than the one where the accident occurred. Based on the testimony of the bridge and building supervisor and two bridge inspectors, and examination of the site, the failure of the bridge was ascribed to the washing out of one or more bents, due to the pressure of drift against the upstream side. While the report of the bureau does not hold the section foreman responsible, it closes with the following comment: "Had he properly inspected the bridge, it is possible that he would have found conditions existing that would have prompted him to take necessary action in order to have prevented the accident."

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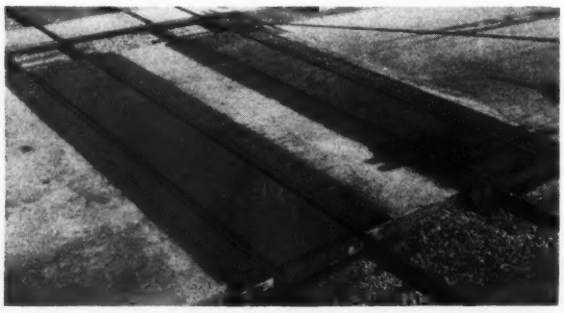
Fatal Collision in England.—Fourteen persons were killed and many injured in an accident on the London, Midland & Scottish Railway at Charfield, England, between Gloucester and Bristol, at five o'clock on the morning of October 13, when a mail train collided with a freight train on the main track.

# New and Improved Devices

## The "Bull Frog" Metal Plate Highway Crossing

A HIGHWAY crossing composed of metal plates and embodying several new features has been developed and placed on the market by the Indianapolis Switch & Frog Company, Springfield, Ohio. It has been designed to provide a durable crossing with a satisfactory surface for either horse-drawn or motor-driven vehicles, as well as to permit its ready removal and replacement when necessary to work on the track through the crossing. It is designated as the Bull Frog unit paving.

The plates are made in standard sizes, those for use between the rails being approximately 28 in. wide, while the side or approach plates are 20 in. wide, and all the plates are furnished in 20 in. lengths, thus providing units of a size and weight which can be handled easily by the track forces. In addition, this size permits the use of the standard plates for skew crossings of any angle without special end plates and without the waste which would occur at the ends of such crossings if the plates were longer. The metal of which the plates are composed is said to have high resistance to heavy impact and to provide units with a factor of

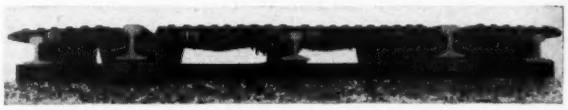


**An Installation of "Bull Frog" Crossings**

safety of 100 per cent under the maximum loads now carried by highway vehicles and the anticipated increase of these loads. The surfaces of the plates are provided with bosses to prevent skidding.

Each plate is anchored to the base of the running rail by jaws which are protected from contact with the metal by heavy blocks or cushions of a resilient material similar to that used in the manufacture of solid rubber tires. These blocks prevent wear or breakage of the jaws or rail by eliminating contact of metal with metal; they also absorb shocks and eliminate noise from traffic passing over the crossing. In addition, they provide insulation where track circuits are used, or permit their installation without entailing any additional work at the crossing except the application of bond wires. The jaws and cushions are so designed that the blocks supporting the latter may be raised or lowered to fit various sections of rail, thus making the crossings available for any location regardless of the weight of rail.

The free ends of the plates are supported by stringer rails, for which second-hand rails, about one inch lower than the running rails, may be used. One of these



**Sectional View of Crossing**

stringer rails coincides with the center line of the track to receive the ends of center plates, while those for the approach plates are located near the ends of the ties. The bottoms of the plates are provided with lugs which fit against the sides of the head of the stringer rails. Each plate interlocks with adjacent plates, and after all the plates have been placed in position, timber blocks with beveled edges are spiked to the ties at the ends of the crossing to protect the plates from damage by dragging equipment and to prevent their removal by accident or design until the blocks have been removed.

In placing the plates, work proceeds each way from the center of the crossing, thus permitting this operation to be carried on simultaneously at six different points: two for the center plates and four for the approach plates. When necessary to work on the track through the crossing, the end blocks are taken up and the plates are removed in the reverse order from which they were laid. Unless it is necessary to uncover the track through the entire length of the crossing, part of the crossing may be left in service while the remainder is taken up. If desired, the center plates may be removed without disturbing the approach, or vice versa.

While it is preferable that the surface of the crossing and the surface of the highway on either side be at the same level, minor differences occasioned by the settlement or raising of the track may be adjusted by vary-

ing the heights of the supports of the approach plates. Since the crossing, by its design, maintains a fixed relation with the track structure, settlement of the track or its subsequent raising has no ill effect on the surface of the crossing itself.

It is said that the installation of these crossings, including the laying of the stringer rails, can be done at a labor cost of five cents a lineal foot and that the maintenance and depreciation costs are negligible.

## A New Flood-Light Attachment

THE Prest-O-Lite Company, Inc., New York City, has recently put on the market a new flood-light unit which is designed especially for convenient use with the small capacity tanks of dissolved acetylene which are available at Prest-O-Lite service stations throughout the country. The new attachment, which consists essentially of a reflector, a burner and an arrangement of special pipe fittings, is of strong and compact construction, and affords a powerful flood-lighting unit which can be moved about conveniently. This makes the unit particularly adaptable for a wide range of maintenance and construction work where readily portable equipment is desirable.

**The New Prest-O-Lite Attachment**

A special feature of the new attachment is to be found in the head construction, where a single swing joint provides for universal adjustment of the direction of the flare. This greatly minimizes the possibility of the leakage of gas. Another feature of the unit is a new type of burner, which it is claimed, will not "carbon up." This burner is placed at a fixed focal point and requires no adjustment. The reflector provided with the unit is of polished aluminum, ten inches in diameter, and can be taken off by removing a single knurled nut. Depending upon the size of tanks used, the entire flood-light unit weighs from 27 to 47 lb. and can, therefore, be moved about readily by one man. Handling of the unit has been made especially convenient through the sturdy construction of the attachment, which is suitable for use as a handle.

## New Paint Has Metallic Lead Body

A PROTECTIVE coating material, designed for both interior and exterior application on metal, wood, concrete and other similar materials, as a protection against the elements, moisture, dampness and chemical fumes, has been introduced in this country recently by Subox, Inc., New York City. This material, which is manufactured in Switzerland, is known as Subox, and is based on a pigment of suboxide of lead, $Pb_2O$, which, through an electro-chemical process, is obtained in such a high degree of dispersion as to be mainly colloidal. Through its special qualities, it is said that permanent suspension in the vehicle is obtained, previous oxidation is prevented, and application of the material is accordingly made in the same manner as a paint. Through great chemical activity when applied, a metallic lead coating is finally established, which is embedded in the underlying surface so as to act as a filler and sealer. This coating is claimed to be impervious to moisture and to resist chemical fumes as well as the elements. Subox is said to be particularly resistant to sulphuric or ammonia fumes, and on account of the chemical changes which take place in its application, is said to increase in efficiency through weathering and exposure. It is independent of the vehicle for its life, obtaining its maximum efficiency when the vehicle, in its original form, has disappeared. It is claimed that it does not peel, chip or crack.

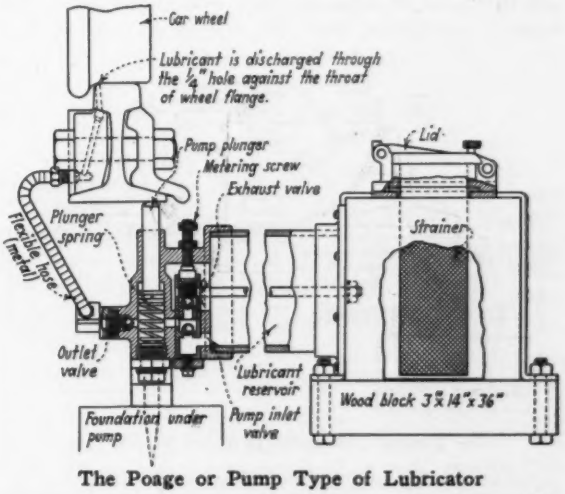
Subox comes in only one color, dark gray. It is delivered ready for use and is equally suitable as a primer or top coat; for use by itself or in conjunction with other materials; and on new construction or for general maintenance. It can be applied over firm rust, in which case it retards further corrosion. It also adheres to galvanized surfaces, providing they have been pickled or weathered.

Subox is adapted particularly for structures and equipment exposed to the elements. When used as a bridge paint, it is said to require a much smaller amount by weight than lead or zinc paints. It is recommended particularly for places which are hard to reach, and where long life in the surface coating is particularly desirable.

## Two New Rail and Wheel-Flange Lubricators

THE American Valve & Meter Company, Cincinnati, Ohio, has recently placed on the market two new devices that are designed to lubricate curve rails and wheel flanges, and thereby reduce curve friction and rail wear. Both are roadway devices, being attached to the high rail on or near the curve, and both depend for their action on the wave motion or depression of the track under traffic. However, in other respects, they have essentially different characteristics.

One of of these, the Poage lubricator, is essentially an oil pump with a reservoir. The latter is T-shaped,




**The Poage or Pump Type of Lubricator**

the stem of the "T" being a piece of 6-in. pipe, 18 in. long, which is connected by a flange to a rectangular steel box 10 in. by 10 in. in section and 32 in. long. This T-shaped reservoir, which has a capacity of 15 gal.

of oil, is mounted in a horizontal position outside the high rail on heavy wooden blocks, with the square portion on the outside, in a position parallel with the rail, and with the end of the 6-in. pipe below and just clear of the rail.

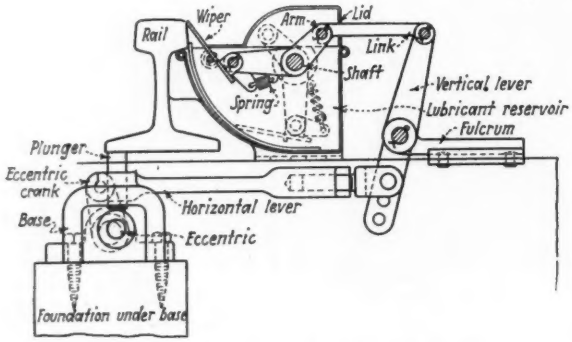
This end of the reservoir is fitted with a casting in which is incorporated a small single-acting plunger pump with ball valves. The plunger of this pump, which is in a vertical position, has an extension at its upper end that comes in contact with the underside of the rail. As the rail moves up and down under traffic, it actuates the pump, which forces oil through two small flexible metal hose, each of which is attached to a metal block or rail unit bolted against the inside face of the rail web. From the hose the oil passes upward through a hole drilled in this block to the fishing surface on the underside of the railhead where it passes through a ¼-in. hole in the head to an outlet where the side of the ball joins the running surface. Thus, the pumping action forces the oil out where it will be picked up by the throat of the wheel flange.

In addition to an inlet and a discharge valve, the pump is provided with a regulating or exhaust valve, equipped with a metering screw and spring by means of which any excess lubricant is pumped back into the reservoir when the pressure in the pump chamber exceeds any predetermined amount. It is thus possible to regulate the amount of oil delivered to the rail to suit traffic conditions. As the reservoir is not under pressure, oil is pumped only while the wave action of the rail is taking place. Consequently, the stopping of a train, with a wheel directly over the plunger, does not result in a continued flow and waste of oil.

The two rail units furnished with each Poage lubricator are attached to the rail 27 in. each way from the center line of the pump, thus insuring that each wheel flange receives two applications of the lubricant. The first of these two units is placed 9 ft. ahead of the beginning of the curve.

### The Tanner Lubricator

The other design is known as the Tanner wheel flange lubricator and consists of an oil trough 4 ft. long, placed inside the rail and spiked to the ties independent of the rail, into which a metal wiper is alternately dipped and lifted out to wipe the gage side of the rail. This wiper is secured at each end to a lever attached to a horizontal shaft. This shaft is mounted on trunnions in each end of the trough and is equipped with coil springs that normally hold the wiper in position against the gage side of the rail.




**The Tanner Lubricator is of the Wiper Type**

This shaft is also connected by a train of levers to a longitudinal shaft mounted on a substantial foundation block bedded in the roadbed between two ties so that a plunger in contact with the underside of the rail base will bear on an eccentric on this shaft. Therefore, when the rail is depressed, motion is set up in the levers which causes the wiper blade to be pushed down into the oil in the trough, but as soon as the wheels pass and the rail rises, the blade is again forced up against the gage side of the rail. Thus the oil is alternately wiped on the side of the rail head and carried away by the wheel flanges. On single track, this lubricator is installed at the middle of the curve and on double track, at the beginning. It is said that it can be installed by two men in three hours or less.

Both of these devices have been subjected to actual service in test installations where they are said to give thoroughly satisfactory service.

## New Portable Circular Saw for Cutting Heavy Timbers

A NEW model of the Crowe safety saw, designated as CC-16, has been placed on the market by the Crowe Manufacturing Corporation, Cincinnati, Ohio, for the purpose of providing a portable circular saw capable of cutting heavy timbers. The saw has a cutting depth of 6⅛ in., and thus can saw through timbers 12 in. thick when the stick can be turned over. In a recent test, one of these saws is said to have cut through an oak timber, 6 in. by 14 in., in 20 seconds.

The body of the tool is made of an aluminum alloy to provide light weight and the saws can be furnished with either electric or air-driven motors. The motor is controlled by a trigger in the handle; when a cut is completed the release of pressure on the trigger stops the motor and the safety guard returns and locks automatically in the closed position. It is said that the safety features of the device have been approved by the Underwriters' Laboratories, the State Industrial Commission of Ohio, the Department of Labor of the State of New York, the Department of Labor and Industry of the State of Pennsylvania and other authoritative safety organizations.

**A Crowe Safety Saw Cutting 6 In. by 10 In. Timbers on the Baltimore & Ohio Chicago Terminal**

In addition to model CC-16, Crowe safety saws are made in four other sizes, with cutting capacities of 1½ in., 2½ in., 3 in. and 4⅛ in.

# With the Associations

### The Tie Producers Association

The eleventh annual convention of the National Association of Railroad Tie Producers will be held at the Arlington Hotel, Hot Springs, Ark., on April 23-25, 1929.

### International Track Supervisors' Club

The seventh annual meeting of the International Track Supervisors' Club will be held at the Hotel Statler, Buffalo, N. Y., at 1 p. m. on Thursday, November 8. The subjects which will be discussed at this meeting are, "Best Methods for Installing and Maintaining One-Piece Manganese Guard Rails" and "Boarding Camps and What They Should Be to Care for Laborers Properly." Election of officers will also take place at this meeting.

### Roadmasters' Association

At a meeting of the executive committee, held on the evening of September 20 following the adjournment of the Detroit convention, C. W. Baldridge, assistant engineer, Atchison, Topeka & Santa Fe, Chicago, was appointed a member of the executive committee to fill the unexpired term of C. J. Coon, assistant engineer, New York Central, resigned.

At the same meeting, H. R. Clarke, president, was authorized to co-operate with A. H. Told, representing the Track Supply Association, in an investigation of the hotels in Chicago, the city selected at the Detroit convention for the next annual meeting, and given authority to act. This committee has selected the Hotel Stevens as the headquarters for the next annual meeting, which will be held on September 17-19, 1929. The facilities for the convention and exhibit at this hotel are more liberal than have been available for any previous convention, a fact which should contribute materially to the success of the next meeting.

### The Wood Preservers' Association

At a meeting of the executive committee at Pittsburgh, Pa., on October 27, action was taken authorizing the printing of the specifications adopted at the Montreal convention in the Manual of Recommended Practice. It is expected that these specifications will be distributed to the members in printed form within two months.

Plans were also considered for the next annual convention, which will be held at the Brown hotel, Louisville, Ky., January 22-24, 1929. In addition to the reports of committees on various phases of wood preservation, materials and practices, the executive committee is arranging for a number of special papers of unusual interest. Among these will be a paper by Dr. Thomas E. Snyder, entomologist of the U. S. Department of Agriculture, entitled "Termites—Destroyers of Wood—and Man's Fight Against Them" and a paper by J. D. MacLean of the Forest Products Laboratory, Madison, Wis., entitled "Absorption of Wood Preservatives Should Be Based on Dimensions of Timbers." Because of the extensive wood preserving interests in and near Louisville, it is expected that this convention will be one of the most largely attended in the history of the association.

### Maintenance of Way Club

The Club held its eighth annual dinner at the Auditorium hotel, Chicago, on Wednesday evening, October 24, with an attendance of 135. The speaker of the evening was Howard P. Savage, manager of the Metropolitan Motor Coach System, who read a paper on motor coaches as a factor in passenger transportation. In the business meeting, the following officers were elected: President, M. D. Carothers, assistant engineer maintenance, Baltimore & Ohio Chicago Terminal; first vice-president, R. N. Wade, engineer maintenance of way, Chicago Rapid Transit Company; second vice-president, J. de N. Macomb, assistant to president, Inland Steel Company; secretary-treasurer, W. S. Lacher, managing editor, *Railway Engineering and Maintenance*.

The next meeting, which will be held on November 21, will be designated as past presidents' night, when it is hoped that all seven past presidents will be guests of the club.

### American Railway Engineering Association

Prompt action of the Board of Direction in approving the assignment of work and personnel of committees early in the year has been fruitful of results, for nine of the standing committees have already completed their reports and submitted them to Secretary Fritch for publication. The committees, whose reports have been completed are Standardization, Water Service and Sanitation, Yards and Terminals, Clearances, Rules and Organization, Shops and Locomotive Terminals, Wood Preservation, and Roadway.

Further impetus is to be given to the work of committees during the coming year by having the selection of committee members and assignment of work completed by January 1, 1929. It is hoped by this means to establish the idea that committee work is to be carried on continuously.

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### Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 15-17, 1929, New Orleans, La.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 5-7, 1929, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 22-24, 1929, Louisville, Ky.

Bridge and Building Supply Men's Association.—W. D. Waugh, secretary, Detroit Graphite Company, Railway Exchange Building, St. Louis, Mo. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds; secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April 23-25, 1929, Arlington Hotel, Hot Springs, Ark.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 17-19, 1929, Chicago.

Track Supply Association.—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

# The Material Market

IN KEEPING with the growing practice of recent years, the roads are now entering the market for their rail requirements for the coming year. Supplementing orders from three large railroads, which aggregated 100,000 tons, reported in last month's issue, orders were placed by six other systems during October to the amount of 554,000 tons. The largest purchase was that of the New York Central, which has placed orders totaling 191,550 tons. The next largest order placed during the month was that of the Pennsylvania, which has placed orders for 159,600 tons out of a total authorization of 260,000 tons, each order carrying an option permitting the railroad to specify delivery for tonnages 70 per cent in excess of the orders. This compares with orders by this road for 200,000 tons last year, with options on 100,000 tons in addition, which were exercised to the extent of about 50,000 tons. Another large order was that of the Atchison, Topeka & Santa Fe for 113,647 tons. The Erie placed orders for 46,622 tons, the Reading for 30,000 tons and the Detroit, Toledo & Ironton for 12,500 tons.

In addition to these orders the Chicago, Burlington & Quincy and the Texas & Pacific are each expected to enter the market for 30,000 tons.

**Iron and Steel Prices Per 100 Lb.**

| | September | | October | |
|---|---|---|---|---|
| | Pittsburgh | Chicago | Pittsburgh | Chicago |
| Track spikes | $2.80 | $2.80 | $2.80 | $2.80 |
| Track bolts | 3.80 | 3.80 | 3.80 | 3.80 |
| Angle bars | 2.75 | 2.75 | 2.75 | 2.75 |
| Tie plates, steel | 2.15 | 2.15 | 2.15 | 2.15 |
| Boat spikes | 3.00 | 3.00 | 3.00 | 3.00 |
| Plain wire | 2.40 | 2.45 | 2.45 | 2.45 |
| Wire nails, keg | 2.55 | 2.60 | 2.55 | 2.60 |
| Barb. wire, galv. | 3.20 | 3.25 | 3.20 | 3.25 |
| C. I. pipe, 6 in. to 12 in. ton | | $42.20 to 43.20 | 43.20 | 45.20 |
| Plates | $1.85 to 1.95 | 2.00 to 2.10 | $1.90 to 2.00 | $2.00 to 2.10 |
| Shapes | 1.85 to 1.95 | 2.00 to 2.10 | 1.90 to 2.00 | 2.00 to 2.10 |
| Bars, soft steel | 1.85 to 1.95 | 2.00 to 2.10 | 1.90 to 2.00 | 2.00 to 2.10 |
| Rivets, struc | 2.90 | 3.00 | 2.90 | 3.00 |
| Con. bars, billet | 1.90 to 2.00 | | 2.00 | |
| Con. bars, rail | 1.75 | 1.85 | 1.85 | 1.95 |
| Rail per gross ton f.o.b. mills | 43.00 | 43.00 | 43.00 | 43.00 |

The same condition prevails with respect to the output of track accessories. Thus, the needs of the Santa Fe have been estimated at 30,000 tons, while the Pennsylvania has announced its decision to spend about $6,500,000 for its requirements in track accessories. A large order for track accessories has been placed by the Reading, while the Great Northern has purchased 7,000 tons and the Chesapeake & Ohio about 13,000 tons.

The prices of track materials are strong, but quotations remain unchanged. Greater strength is also manifest in the prices of structural steel. Owing to heavy bookings during September and early October, orders which the mills now have on hand are larger, and dates of delivery have been set further ahead than has been the case for some time. This has placed the manufacturers in a position to establish the new fourth-quarter prices on a firm basis, in fact, some producers are asking premiums on new business.

The significant feature at the present time is the greater relative strength of prices in the Pittsburgh territory, which is reflected in the greater production activity there as compared with Chicago, the direct reverse of the condition which existed for some time in the past. Steel production in the Pittsburgh district during October was estimated at 90 per cent of capacity and in the Chicago territory at 85 per cent.

The demand for wire and wire products has suffered a seasonal decline but prices remain steady. Cast iron quotations are higher and scrap is in demand.

Orders for southern pine during the week ending October 5 were larger than in any week since April 13, except the week ending September 14, and exceeded the cut by 20 per cent. The volume of sales during the following week were nearly as great, but in the week ending October 19, orders fell off to such an extent as to wipe out the gain made in the total of unfilled orders during the two previous weeks. Purchases by southern railroads have featured that market in recent weeks. Prices are strong. The demand for Douglas fir has decreased. Orders during the week ending October 15 totaled 17 per cent less than production. Prices have shown some weakness but not in the items listed here.

**Scrap Prices Per Gross Ton at Chicago**

| | September | October |
|---|---|---|
| Relaying rail (including angle bars) | $26.00 to $31.00 | $26.00 to $31.00 |
| Rails for rerolling | 16.00 to 16.50 | 16.50 to 17.00 |
| Rails less than 3 ft. long | 17.00 to 17.50 | 17.25 to 17.75 |
| Frogs and switches cut apart | 14.75 to 15.25 | 15.50 to 16.00 |
| Steel angle bars | 15.75 to 16.25 | 16.50 to 17.00 |

**Southern Pine Mill Prices**

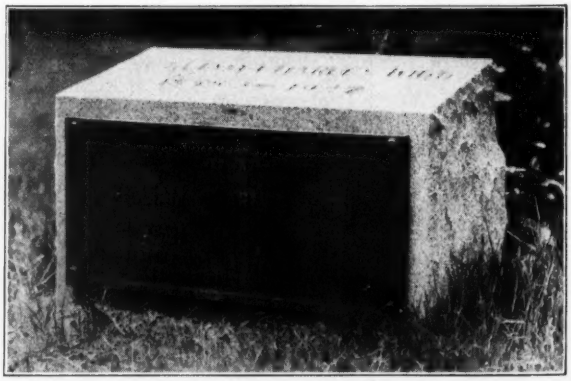
| | September | October |
|---|---|---|
| Flooring, 1x4, B and better, flat | $40.18 | $40.43 |
| Boards, 1x8, No. 1 | 31.43 | 34.70 |
| Dimension, 2x4, 16, No. 1, common | 29.04 | 28.84 |
| Dimension, 2x10, 16, No. 1, common | 29.50 | 31.71 |
| Dimension, 2x4, 16, No. 2, common | 25.47 | 24.33 |
| Dimension, 2x10, 16, No. 2, common | 25.39 | 24.88 |

**Douglas Fir Mill Prices**

| | September | October |
|---|---|---|
| Flooring, 1x4, B and better, flat | $25.75 | $25.25 |
| Boards, 1x8, No. 1 | 17.25 | 18.50 |
| Dimension, 2x4, 16, No. 1, common | 19.00 | 20.50 |
| Dimension, 2x10, 16, No. 1, common | 18.75 | 19.50 |
| Dimension, 3x3 to 4x12, No. 1 common | 19.75 | 22.00 |
| Dimension, 5x5 to 12x12, No. 1, common rough | 17.50 | 17.75 |

Stocks of Portland cement in the hands of the manufacturers decreased from 19,340,000 bbl. to 16,722,000 bbl. during the month of September, because of the fact that production during September, amounting to 17,856,000 bbl., or 91.7 per cent of capacity, was exceeded by shipments which totalled 20,462,000 bbl. However, in spite of this reduction in stocks, they totalled 19.5 per cent higher at the end of September than a year ago. Prices of Portland cement have been subjected to a number of adjustments. Of those listed in the table below, that for New Orleans is higher and those for Denver and Dallas are lower. These prices are per barrel in carload lots, not including package.

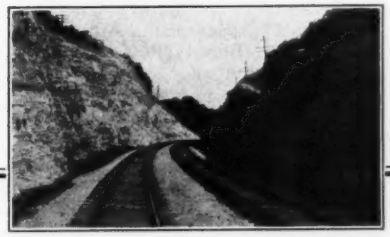
| | | | |
|---|---|---|---|
| New York | $2.25 | Minneapolis | $2.22 |
| Pittsburgh | 2.04 | Denver | 2.55 |
| New Orleans | 2.40 | Dallas | 2.15 |
| Chicago | 2.05 | San Francisco | 2.41 |
| Cincinnati | 2.22 | Montreal | 1.41 |



**Bronze Tablet at "Captain" Kidd's Grave**

Through the co-operation of the Roadmasters' and the Track Supply Association, this tablet was placed at the grave of W. C. Kidd, who was for many years secretary of the latter organization

# Railway News



# Briefly Told

**Revenue freight car** loadings during the week ending October 13 totaled 1,190,127 cars, an increase of cars over the corresponding week of last year, but a decrease of 12,653 cars as compared with the same week of 1926. The cumulative total for the first 41 weeks of the current year was 40,593,854, as compared with 41,395,755 and 41,950,337 for the corresponding periods in 1927 and 1926, respectively.

**The Atlanta & West Point,** the Western Railway of Alabama and the Georgia Railway, which are under the same management, have "air-marked" the names of a number of stations on their lines between August, Ga., and Selma, Ala., as an aid to the development of aviation. The names of the stations are painted in eight-foot letters on the roofs of the buildings and, where possible, are illuminated at night.

**The "last spike"** on the Flin Flon branch of the Hudson Bay Railroad, on which construction was begun about the first of the present year, was driven by John Bracken, premier of the Province of Manitoba, on September 22 at a point 84 miles north of the junction with the main line at Sheman, Man., near The Pas. The branch was built to serve the Flin Flon mining district near the Manitoba-Saskatchewan border.

**According to figures** compiled by the Bureau of Railway Economics, the daily average movement of freight cars during August was the highest for any August on record, amounting to 32.1 miles a day, as compared with an average of 30.9 miles a day in August, 1927, and of 31.6 miles a day for August, 1926. The daily average movement for the first eight months this year was also the highest ever attained in any corresponding period, amounting to 30.3 miles a day, an increase of 0.4 miles over the same period of 1927 and of 0.7 miles over 1926.

**The emergency** board of mediation appointed by President Coolidge to ascertain the facts in the controversy over the wage increase asked by the conductors and trainmen of the Western railways has found that an increase of 6½ per cent with no change of working conditions, or of 7½ per cent with the elimination of the double-header and tonnage-restriction rules, both of which had been offered by the railways, should be the basis of settlement. The board recommended that these proposals be again submitted to the employees for their election and that the carriers should abide by such election. It also recommended that whatever proposal is accepted be made retroactive to May 1, 1928. Under the law, neither party to the dispute can take any action as to a strike or lockout until 30 days after the report of the board is made public.

**The Atchison, Topeka & Santa Fe** assumed ownership of the Kansas City, Mexico & Orient on October 19, when a check for $8,600,000 was given the American stockholders of the Orient as final payment for the property, the remainder of the total purchase price of $14,507,500 having been paid to the English noteholders about a month ago. W. B. Storey, president of the Santa Fe, and other general officers of that company were elected to corresponding positions on the Orient, and members of the Santa Fe board of directors were elected directors of the Orient company.

**Grade crossing elimination** in Canada will be greatly promoted by a new interpretation of the legislation governing the administration of the grade-crossing fund by the Dominion Railway Board. Heretofore, contributions from the fund were made only when separation was attained by the construction of underpasses or over crossings, or where the highway was relocated to do away with a crossing. Under the new ruling, contributions from the fund may be made for work which will divert a substantial volume of traffic from a grade crossing, even though the crossing must be maintained for local use.

**An increase** of 4.9 per cent in carload shipments of the 29 principal commodities for the fourth quarter of this year, as compared with the same period in 1927, is indicated by estimates made by the regional shippers' advisory boards and furnished to the Car Service Division of the American Railway Association. Eleven of the 13 advisory boards anticipate an increase in shipments in their respective districts, these ranging from 2.9 per cent in the New England district to 15.6 per cent in the Allegheny district. The Central Western district forecasts a decrease of 2.4 per cent in its territory, while the Ohio Valley district estimates that it will have a decrease of 9.1 per cent. The total loadings for the specified commodities for the quarter are estimated at 9,279,472 cars, or an increase of 431,599 over the same period last year.

**The Public Service Commission** of the State of New York, since the adoption of the $300,000,000 bond law for eliminating grade crossings outside of Greater New York, has ordered 234 eliminations at an estimated cost of $27,200,000. Under the law, the state pays 40 per cent of the total cost, instead of 25 per cent and the municipality 10 per cent instead of 25 per cent, as formerly, the railways involved paying 50 per cent as heretofore. The legislature has appropriated $60,000,000 for grade crossing elimination outside of Greater New York and $10,000,000 worth of bonds have been sold, while further bonds will be sold as the money is needed.

**The hearing** on an application of the Denver & Salt Lake Western for authority to construct the Dotsero cut-off from the Moffat tunnel to a connection with the Denver & Rio Grande Western closed on September 21 and both the applicant and the D. & R. G. W. as intervenor were given 30 days in which to file briefs with the Interstate Commerce Commission. At the hearing, which was held at Denver by the Public Utilities Commission of Colorado for the I. C. C., the D. & R. G. W. announced that if the D. & S. L. W. were allowed to operate the proposed cut-off, it would apply to the commission for authority to construct a rival cut-off and tunnel to shorten its line between Denver and the West.

**A gross load** of 365 tons on one car was hauled by the New York, New Haven & Hartford on October 5 and 6 from Worcester, Mass., to Maybrook, N. Y. The shipment consisted of a 14-in. gun from the United States Arsenal at Watertown, Mass., mounted permanently on a car body 85 ft. long, with four trucks and a total of 14 pairs of wheels. The axle loads ranged from 49,750 lb. to 54,000 lb. The speed of the train carrying the shipment was limited to 20 miles an hour at all points; to 15 miles an hour over steel bridges, and to 10 miles an hour over timber bridges and the Poughkeepsie bridge across the Hudson river. The destination of the shipment was Aberdeen, Md., and it was routed via the Lehigh & Hudson River to Belvidere, N. J., where it was delivered to the Pennsylvania for the remainder of the trip.

## Construction News

**The Atlantic & Northwestern** has been authorized by the Interstate Commerce Commission to construct a line from Mount Pleasant, S. C., to McClellanville, about 32 miles, and also from McClellanville to Jamestown, 18 miles.

**The Atchison, Topeka & Santa Fe** has awarded a contract for the construction of a viaduct over the tracks of this company and of the Missouri Pacific, at East Sixth avenue, Topeka, Kan., to the Kansas City Bridge Company, Kansas City, Mo. The structural steel for the viaduct will be furnished by the American Bridge Company, Chicago. The city of Topeka will pay about $162,000 towards the cost of the structure, the remainder of the expenditure to be borne by the two railroads.

The Interstate Commerce Commission has made public a proposed report by Examiner H. C. Davis recommending that the commission grant the application of the Cane Belt, a subsidiary of the Santa Fe, for a certificate authorizing the construction of a 35-mile line from a point on its Lane City-Magnet line to a connection with the Gulf, Colorado & Santa Fe near Thompsons, Tex. The examiner recommends denial of the application of the St. Louis, Brownsville & Mexico for authority to construct extensions from a point between Brazoria and Allenhurst northwest to the boundary line between Fort Bend and Wharton counties, 25 miles, and from a point near Algoa northwest to Dickinson, 9 miles.

**The Big Sandy & Cumberland** has closed bids for the construction of a line from a point one mile east of Devon, W. Va., through Hurley, Va., and Grundy to the Kentucky-Virginia state line along the Levisa river, 39 miles. This project will involve the excavation of 2,655,000 cu. yd. of material for roadway construction and the driving of two tunnels, 4,000 ft. and 1,600 ft. long respectively, with the excavation of 135,000 cu. yd. of material. Structures on the new line will include a bridge over Tug river at Lower Elk, Ky.

**The Calhoun Bridge Company,** which is controlled by those interested in the proposed Alton, Quincy & Northern, has awarded a contract to the Owens Construction Company, New York, for the construction of a combined railroad and vehicular bridge over the Illinois river near Grafton, Ill., at a cost of $700,000.

**The Canadian National** has closed bids for the construction of a frame and stucco passenger station and a frame freight shed at Weyburn, Sask.; for re-decking and roofing the machine shop at Winnipeg, Man., which has dimensions of 163 ft. by 572 ft.; for the construction of additions to the station at Ft. Frances, Ont., and for the construction of insulated roofs on the roundhouse, machine shop and boiler room at Radville, Sask.

**The Chesapeake & Ohio** has awarded a contract for the construction of a water-treating plant at Lake Bruce, Ind., to the Bickelhoff Construction Company, Richmond, Va.

A contract has been let to the Roberts & Schaefer Company, Chicago, for the rehabilitation of a coaling station at Handley, W. Va.

This company has filed with the Interstate Commerce Commission a further petition for reconsideration and reargument of the case in which the commission recently authorized the Norfolk & Western and the Virginian, through subsidiaries, to build extensions in the Guyandot valley of West Virginia, while denying the application of the C. & O. for a certificate authorizing an extension in the valley. The commission has denied a petition for a reconsideration but the C. & O. now asks a reargument before the entire commission only as to the grant of a certificate to the Guyandot & Tug River, the N. & W. subsidiary and the failure to grant trackage rights to the C. & O. over the Virginian between Gilbert and Stone Coal, W. Va. The commission, in response to the petition, has further postponed to November 22 the effective date of the certificate and order issued in this case except in so far as they authorized the Virginian & Western to construct its extension.

**The Chicago, Rock Island & Pacific** has awarded a contract for the construction of a water treating plant with a capacity of 18,000 gal. per hr. at Stewart, Iowa, to the Railroad Water & Coal Handling Company, Chicago.

Authorization has been given for the construction of an extension of the Amarillo-Stinnett branch to a connection with the main line of the Rock Island at Liberal, Kan. The new extension will be constructed from Gruver, Tex., to Liberal, about 60 miles. Construction is now in progress from Stinett, Tex., to Gruver.

**The Delaware, Lackawanna & Western** has purchased 15 acres of land in north Jersey City on which it will erect a warehouse to be devoted to general storage, warehouse and distribution purposes. The main building will be 848 ft. by 162 ft. in area, of steel, concrete and brick construction. The first and second floors will contain l.c.l. freight stations, while all other floors will be used for warehouse, storage, manufacturing and assembling purposes. Extensive l.c.l. freight and warehouse delivery platforms, provided with tail-board space sufficient to accommodate 113 vehicles at one time all under cover and entirely clear of city street areas, will be provided at the street level. The warehouse portion of the building will be served at the second-floor level by tracks having a total capacity of 52 cars, while tracks having a capacity of 70 cars will serve the l.c.l. freight station from the opposite side of the building.

**The Grand Trunk Western** has awarded a contract for the construction of a bridge over the St. Joseph river at South Bend, Ind., to Foley Bros., St. Paul, Minn. The bridge will also span Lincoln highway and the East and North Shore boulevard. This contract also covers the construction of an arch bridge over Mishawaka avenue in South Bend. All of this work is part of a diversion program which will remove the Grand Trunk tracks from Dision street in South Bend, while the railroad will gain entrance to the new union station over the New York Central track elevation.

A contract for the construction of a portion of the belt line at Pontiac, Mich., has been awarded to the Jones Contracting Company, Cleveland, Ohio.

**The Great Northern** has announced plans for the immediate construction of a two story office building at Fourth avenue and Union street, Seattle, Wash., which will serve as a ticket office and provide headquarters for traffic officers. It is expected that this building, which will have outside dimensions of 55 ft. by 111 ft., will be the first unit of a larger building which will eventually become permanent Great Northern headquarters in Seattle.

**The Laramie Valley** has awarded a contract to N. A. Swenson, Laramie, Wyo., for the construction of bridges, trestles and culverts on the 10 miles of line under construction between Laramie and the quarries of the Molith Portland Company.

**The Louisville & Nashville** is receiving bids for the construction of a passenger station at Bay St. Louis, Miss., which it is estimated will cost about $50,000. The two-story structure will be constructed of stucco over tile or brick and will have outside dimensions of 30 ft. by 125 ft.

A contract for the construction of buildings and other structures in connection with the new yard and terminal at Mobile, Ala., has been let to the W. Horace Williams Company, New Orleans, La. Work to be done under this contract includes the construction of a 17-stall brick roundhouse, a machine shop, a boiler and blacksmith shop, a power house, an office building, a store house, a yard office, a trainmen's building, stock pens, a car shop, a 500-ton coaling station, cinder pits, and water supply system. Tracklaying in the yards will be undertaken by company forces.

**The Memphis & Arkansas Railway Bridge & Terminal Company** has awarded a contract for repairs to the Harahan bridge over the Mississippi river at Memphis, Tenn., which was damaged by fire on September 17, to the American Bridge Company, Chicago.

**The Michigan Central** has announced tentative plans for the use of the right of way of this company for a track elevation project at Hammond, Ind., which will involve the use of the elevated

structure by all railroads now running through that city. The total cost of the project, including the construction of a union station at State and Hohman streets, is expected to be about $8,000,000, with the city paying 75 per cent of the cost under the present state law and the railroads 25 per cent.

**The Minneapolis, St. Paul & Sault Ste. Marie** has let contracts for the construction at Ashland, Wis., of a five-stall brick engine house, the remodeling of four stalls of the present engine house, and the construction of a machine shop, boiler house, storeroom, oil house, a 100-ton automatic coaling station and a single-track automatic cinder conveying plant.

**The Missouri Pacific** has announced that the double-track freight line which it is planned to construct before 1932 between Valley Park, Mo., and a point near Jefferson Barracks, will, with the bridge which it is planned to construct over the Mississippi river, involve an expenditure of about $9,000,000. It is expected that the line will have maximum grades of 0.3 per cent and will thus permit through traffic to avoid heavy grades on the present line from Valley Park into St. Louis.

**The New Jersey, Indiana & Illinois** has awarded a contract for the construction of a three-stall roundhouse at South Bend, Ind., to John Nelson & Co., South Bend, at a cost of about $50,000.

**The New York Central** has awarded contracts for alterations and additions to its engine house at Rensselaer, N. Y., to the Walsh Construction Company, Syracuse; for the modification of the express platform at the Grand Central Terminal, New York City, to the Ruggles-Robinson Company, New York; for the enlargement of the classification yard and the extension of bridge 591 at De Witt, Syracuse, N. Y., to the Walsh Construction Company; for the extension of platform canopies, and fences at Marble Hill, Greystone, Hastings, Dobbs Ferry, Ardsley and Irvington, N. Y., to the Edward J. Duffy Company, Inc., N. Y.

A contract has been let to the Roberts & Schaefer Co., Chicago, for the installation of one three-track and one two-track electric cinder pits at Waynesport, N. Y. A contract has also been awarded to the Railroad Water & Coal Handling Co., Chicago, for the construction, at Elkhart, Ind., of a water treating plant which will have a treating capacity of 150,000 gal. per hour. Equipment to be installed at the plant will include a tank 62 ft. in diameter and 43 ft. 6 in. in height, with four 10-ft. 6-in. downtakes.

**The New York, Chicago & St. Louis** has awarded a contract to the Roberts & Schaefer Company, Chicago, for the construction of a cinder handling plant at Charleston, Ill.

**The Norfolk & Western** has awarded a contract to H. M. Waugh, Williamson, W. Va., for work in connection with a grade crossing elimination and yard extensions at Columbus, Ohio. The project is expected to involve an expenditure of approximately $500,000.

**The Pennsylvania** has awarded a contract to Henry Steers, Inc., New York, for work in connection with filling for approaches to its new bridges over the Hackensack river at Marion, N. J. Approximately 1,300,000 cu. yd. of material will be used for the fills.

A contract for the construction of a single-track electrically operated cinder-handling plant at Norristown, Pa., has been let to the Ogle Construction Company, Chicago.

A contract has been awarded to W. J. Camlin, Newark, Ohio, for the construction of a new freight station at that point. The estimated cost of this structure is approximately $115,000. A second contract for the construction of a new freight house, to cost about $70,000, at Norfolk, Va., has been awarded to R. R. Richardson & Co., Inc., Norfolk, while a third for the construction of an industrial branch on Mill street, Morrisville, Pa., at a cost of approximately $60,000 was given to Ross & Taylor, Trenton, N. J. Work in connection with the relocation of tracks through the plant of the Wheeling Steel Corporation at Steubenville, Ohio, was awarded to the T. J. Foley Company, Pittsburgh, Pa.

**The Southern Pacific** has applied to the Interstate Commerce Commission for a certificate for an extension of its Walnut Grove branch in Sacramento county, Cal., from Walnut Grove to Isleton, 8 miles.

Additions and improvements to the terminal facilities at San. Jose, Cal., to be constructed within the next two years, will involve an expenditure of about $3,250,000. This will include the construction of a new line outside of the congested section of the city and a new passenger station. During the remainder of 1928 it is planned to construct an additional 40,000 ft. of track in the new San Jose yard at a cost of $200,000.

A contract for the grading for a line from Merrill, Ore., to Alturas, Cal., 83 miles, has been let to the Utah Construction Company, San Francisco, Cal.

**The Waco, Beaumont, Trinity & Sabine** has awarded a contract for the construction of extensions from Livingston, Tex., through Bragg, Saratoga, Elizabeth and Beaumont to Port Arthur, and from Weldon, Tex., through Midway, Normangee, Thornton and Mart to Waco, including all stations and similar structures, to the Foundation Company, New York. About 205 miles of new lines will be constructed and about 115 miles of existing lines will be reconstructed. It is planned to construct shop facilities in the terminal district extending from Elizabeth to Port Arthur and at the northern end of the line in the Waco district. Present plans call for the construction of the main shops at Trinity, Tex., where the shops are now located.

# Supply Trade News

## General

**The Potosi Tie & Lumber Company**, St. Louis, Mo., has purchased the entire capital stock of the Hobart-Lee Tie Company, Springfield, Mo. The latter company will continue operations with no change in name or organization, except that R. E. Lee, president and sales manager, B. S. Lee, vice-president and treasurer, and J. L. Lee, assistant to the president of the Hobart-Lee Tie Company.

**The Symons Brothers Company**, Chicago, manufacturer of the Symons cone crushers, has been consolidated with the Nordberg Manufacturing Company, Milwaukee, Wis. Branch offices will be continued as heretofore at New York and Los Angeles, Cal., and the representatives engaged in the sale and servicing of these crushers will continue in the same capacity with the Nordberg Manufacturing Company.

**The Ames Shovel & Tool Company** has begun the construction of a new plant at North Easton, Mass., which will adjoin the company's present factory at that point. The structure will be a one-story building, 400 ft. by 60 ft., of fireproof construction, and equipped with modern machinery arranged for line production. The removal of the company's general office from Boston to North Easton was noted in the October issue of *Railway Engineering and Maintenance*.

## Personal

John A. Manley, who has been for the past three years manager of sales for Fairbanks, Morse & Co., Chicago, has been elected vice-president in charge of sales.

**S. W. Perry**, Monmouth, Ill., formerly representing the DeVilbiss Company, Toledo, Ohio, has joined the sales organization of the Alexander Milburn Company, Baltimore, Md., and has been assigned to the middle western territory.

**A. H. Tischer** has been appointed representative of the Foote Bros. Gear & Machine Company, Chicago, to handle the territory in Indiana south of a line drawn below Ft. Wayne, and also including Louisville, Ky.

**Alonzo F. Allen**, secretary and assistant treasurer of the American Steel & Wire Company, with headquarters at Cleveland, Ohio, has been made secretary and treasurer, succeeding, in the latter capacity, **J. R. Thomas**, who has retired.

**H. H. Sherman**, assistant publicity manager of the Pneumatic Tool Company, New York, with headquarters at New York, has been promoted to publicity manager, with headquarters at the same point. Mr. Sherman became as-

sociated with the company in 1927 as assistant publicity manager.

**H. E. Chilcoat** has been appointed manager of sales of the air-dump car division of the Koppel Industrial Car & Equipment Company, Pittsburgh, Pa., with headquarters at Pittsburgh. Mr. Chilcoat was born at Obisonia, Pa., and entered railway service in 1900 as a machinists' helper on the Pennsylvania at Pittsburgh. He was promoted successively to work inspector, gang

H. E. Chilcoat

foreman and foreman of the air-brake department, resigning in 1906 to become traveling inspector for the Westinghouse Air Brake Company, with headquarters at Richmond, Va. He was later transferred to the sales department at Pittsburgh, where he remained until 1918, when he was appointed manager of the Clark Car Company. In 1926, he entered practice as a consulting engineer, in which he was engaged at the time of his recent appointment as manager of sales of the air-dump car division of the Koppel Industrial Car & Equipment Company.

**P. A. Terrell,** formerly manager of the New Industries division of the Mississippi Power Company, has been placed in charge of central station and railway sales of the Copperweld Steel Company, Glassport, Pa., with headquarters at Chicago. Mr. Terrell graduated from the Alabama Polytechnic Institute in 1917, following which he spent nine months in the General Electric test course at Schnectady, N. Y. He later was a lieutenant in the United States Marine Corps and was in active service in Cuba and Haiti. After his return to civil life, he entered the employ of the Alabama Power Company and was promoted to assistant superintendent of the West division in 1920. He was promoted to superintendent of the Gadsden division in the following year, and to manager of the Jasper district in 1922. He resigned from this latter position in 1927 to become manager of the New Industries division of the Mississippi Power Company, which position he was holding at the time of his recent appointment in charge of central station and railway sales of the Copperweld Steel Company.

# Personal Mention

## General

**H. M. Diver,** assistant superintendent and engineer of the Canton Railroad, with headquarters at Baltimore, Md., has been promoted to superintendent with headquarters in the same city, and the position of assistant superintendent has been abolished.

**H. A. Israel,** master of trains and tracks of the Illinois division of the Missouri Pacific, with headquarters at Dupo, Ill., has been promoted to assistant superintendent of that division, with headquarters at Bush, Ill., and the position formerly held by him has been abolished.

**J. T. Ridgely,** engineer maintenance of way of the Long Island, with headquarters at Jamaica, N. Y., has been promoted to superintendent of the Indianapolis division of the Pennsylvania, with headquarters at Indianapolis, Ind., succeeding **R. R. Nace,** whose promotion to chief engineer maintenance of way of the New York Zone, with headquarters at New York, is noted elsewhere in this issue. A sketch of Mr. Ridgely's railway career, together with a reproduction of his photograph, was published on page 191 of the April, 1928, issue of *Railway Engineering and Maintenance.*

**G. D. Hughey,** superintendent of the Champlain division of the Delaware & Hudson, who is an engineer by education and experience, has been promoted to superintendent of transportation, with headquarters at Albany, N. Y. Mr. Hughey was born on December 7, 1884, at Oakmont, Pa., and was educated at Renssalaer Polytechnic Institute. He entered railway service in 1910 in the engineering department of the Bessemer & Lake Erie, and in 1913 became an inspector in the engineering department of the D. & H., later serving in various other positions. In August, 1917, he was promoted to division engineer of the Champlain division, with headquarters at Plattsburg, N. Y., and later was transferred to the Susquehanna division. He was promoted to superintendent of the Champlain division, with headquarters at Plattsburg, in March, 1925, which position he was holding at the time of his recent promotion to superintendent of transportation.

## Engineering

**Earle B. Sloan,** whose promotion from chief engineer of the Southern Pacific of Mexico to fiscal representative at Mexico City was noted in the September issue, was born on December 9, 1884, at Kansas City, Mo. Mr. Sloan entered railway service in June, 1905, as a topographer on the Southern Pacific of Mexico and later served as draftsman and transitman. He became a topographer on the Chicago, Milwaukee & St. Paul in August, 1906, and returned to the Southern Pacific of Mexico in April, 1907, where he served as a transitman and assistant engineer until June, 1908. From August, 1908, to November, 1909, Mr. Sloan was inspector, designer and transitman on the Copper River & Northwestern, returning again to the Southern Pacific of Mexico in December of the latter year as a draftsman. He was promoted successively to assistant engineer, roadmaster and assistant superintendent, leaving railway service in December, 1917, to engage in private business. He returned to the Southern Pacific of Mexico in April, 1921, where he acted in the capacity of general foreman and later as assistant engineer until August 15, 1922, when he was promoted to chief engineer, which position he held until August 15, 1928, when he was promoted to fiscal representative and president of the local board of directors at Mexico City.

**V. I. Smart,** special engineer on the Canadian National, with headquarters at Montreal, Que., has been promoted to general superintendent of transportation of the Western region, with headquarters at Winnipeg, Man. Mr. Smart was born on February 14, 1876, at Brockville, Ont., and was educated at Upper Canada College and at Queens University. During 1897 and 1898 he was engaged on surveys for the Dominion Government in Western Canada following which he entered railway service in 1900 as an assistant engineer on the Illinois Central at Chicago. He was promoted to assistant signal engineer in 1902, and in 1904 became signal

V. I. Smart

engineer of the Chicago & Eastern Illinois, with headquarters at Chicago. In the following year he was promoted to engineer maintenance of way, in which position he remained until 1907, when he was appointed professor of railway transportation at McGill University at Montreal. He remained in that position until 1914, and during that time he made investigations and recommendations as to improvements in operating conditions on the Intercolonial (now a part of the Canadian National), the

Canadian Pacific and the Canadian National. From 1914 to 1917, Mr. Smart was vice-president and general manager of the General Railway Signal Company of Canada, with headquarters at Montreal, and from the latter year to 1920, he acted as a consulting engineer in that city. From 1920 to 1923, he was a special engineer for the Department of Railways on the arbitration of the Grand Trunk valuation case, following which he was appointed special engineer on the Canadian National, with headquarters at Montreal, which position he was holding at the time of his recent promotion to general superintendent of transportation of the Western region.

**A. C. Watson,** chief engineer of the Long Island, with headquarters at Jamaica, N. Y., has been promoted to chief engineer of the New York zone of the Pennsylvania, which has been formed by the consolidation of the Long Island with the New Jersey division of the Pennsylvania, exclusive of the Atlantic and Camden Terminal divisions, and **R. R. Nace,** superintendent of the Indianapolis division, with headquarters at Indianapolis, Ind., has been promoted to chief engineer maintenance of way of the New York zone. Both of these officers will have their headquarters at New York.

Mr. Watson entered railway service in 1899 as a chainman on the Erie and Ashtabula division of the Pennsylvania, leaving a year later to complete his college course. After graduating from Washington and Jefferson College in June, 1902, he returned to the service of the Pennsylvania, where he remained until April, 1903, when he became an assistant engineer on the Illinois Central System at Vicksburg, Miss. On April 1, 1904, he entered the service of the Vandalia (now a part of the Pennsylvania) and on July 22, 1905, was promoted to assistant engineer on the Indianapolis Terminal and the Vincennes divisions, later being transferred successively to the Richmond, Western and C. & P. divisions. He was promoted to division engineer of the Zanesville division on January 1, 1913, and later served in the same capacity on the Logansport and C. & P. divisions. On the termination of federal control on March 1, 1920, Mr. Watson entered the operating department as superintendent of the Richmond division, and was transferred successively to the Schuylkill, Conemaugh, C. & P. and Middle divisions. He was appointed chief engineer of the Long Island on February 1, 1927, which position he was holding at the time of his promotion to chief engineer of the New York zone on October 1.

**A. C. Watson**

Mr. Nace was born on August 27, 1882, at Tacony, Pa., and was educated at the Northeast Manual Training School, from which he graduated in 1900. He entered the service of the Pennsylvania in December, 1901, as a rodman and was promoted successively to assistant supervisor and supervisor. In 1914 he was transferred to the office of the valuation engineer at Philadelphia, Pa., where he remained until December 1, 1917, when he was appointed supervisor of the Philadelphia Terminal division. On March 1, 1919, he was promoted to assistant engineer maintenance of way, reporting to the assistant to the president, and on March 1, 1920, he was further promoted to engineer maintenance of way of the Eastern Ohio division of the Central region, with headquarters at Pittsburgh, Pa. Mr. Nace entered the operating department on April 1, 1926, as superintendent of the Schuylkill division, with headquarters at Reading, Pa., and was serving as superintendent at Indianapolis at the time of his promotion to chief engineer maintenance of way of the New York zone on October 1.

**C. F. O'Connor,** bridge and building master on the Canadian Pacific, with headquarters at Kamloops, B. C., has been promoted to superintendent of construction of the Western region, with headquarters at Edmonton, Alta., succeeding **R. W. Graham,** who has retired.

**J. L. Campbell,** assistant to the chief engineer of the Southern Pacific, with headquarters at San Francisco, Cal., has been appointed acting chief engineer of the Northwestern Pacific, with headquarters in the same city, succeeding **George H. Hicks,** notice of whose death on October 21 will be found elsewhere in this issue.

**Herbert A. Lathrop,** whose promotion to assistant division engineer of the Coast division of the Southern Pacific was noted in the September issue, was born in 1882 at Swan Lake, Iowa, and graduated from Iowa State College in 1906. Mr. Lathrop entered railway service in July, 1902, as a chainman on the Oregon Railway & Navigation Company (now the Oregon-Washington Railway & Navigation Company). He returned to college in 1903, and, after his graduation in 1906, became a rodman on construction on the Minneapolis & St. Louis in South Dakota. Later in the same year he became an instrumentman on the O. R. & N. at Tekoa, Wash., and in 1908 was promoted to assistant engineer. Mr. Lathrop entered the service of the Southern Pacific in 1910 as an assistant engineer at Sacramento, Cal., and in 1922 was promoted to office engineer at Los Angeles, Cal. He was promoted to acting assistant division engineer at Los Angeles in January, 1928, which position he was holding at the time of his recent promotion to assistant division engineer of the Coast division, with headquarters at San Francisco, Cal.

**Benjamin H. Crosland,** whose promotion to assistant division engineer on the St. Louis-San Francisco, with headquarters at Ft. Scott, Kan., was noted in the September issue, was born at Rochester, N. Y., on July 9, 1891, and was educated at Valparaiso University, where he graduated in 1914. Mr. Crosland entered railway service prior to the completion of his college course, on the location and construction of several railroads in the eastern parts of the United States and Canada. After his graduation, he was engaged in general engineering work in Kansas City, Mo., during 1914 and 1915, when he entered the service of the Western district of the Bureau of Valuation, Interstate Commerce Commission. He was a lieutenant in the 70th Engineers of the United States Army from 1917 to 1919, returning to the Bureau of Valuation at the end of his military service. He entered the engineering department of the Frisco in 1920, where he remained until 1926, when he was promoted to division roadmaster, with headquarters at Kansas City, Mo. Mr. Crosland was holding this latter position at the time of his recent promotion to assistant division engineer.

**James G. Wise,** assistant engineer on the New York Central, with headquarters at New York, has been promoted to assistant terminal engineer, with headquarters in the same city, and **Eugene E. Dietch,** assistant engineer, also with headquarters at New York, has been promoted to assistant district engineer, with headquarters in the same city.

Mr. Wise, after graduating from Ohio State University in 1906, entered railway service with the New York, New Haven & Hartford, leaving that road later in the same year to become connected with the engineering department of the New York Central. He was successively draftsman, instrumentman and assistant engineer on the Grand Central Terminal improvements and was acting in the latter capacity at the time of his recent promotion to assistant terminal engineer.

Mr. Dietch was born at Budapest, Hungary, on April 11, 1881, and was educated at the Royal Polytechnical Institute, from which he graduated in 1901. He entered the service of the New York Central in August, 1904, as a draftsman in the office of the designing engineer at New York, where he was promoted to assistant engineer in 1910, to chief draftsman in 1915 and to assistant designing engineer in 1916.

In 1924 he was appointed an assistant engineer in the office of the district engineer at New York, which position he was holding at the time of his recent promotion to assistant district engineer.

## Track

**H. H. Albert,** extra gang foreman on the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to roadmaster on the Twin City terminals, succeeding **W. Walsh,** who has been assigned to other duties.

**R. E. Adkins** has been appointed acting roadmaster on the Eastern lines of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., succeeding **J. H. Brown,** who has been assigned to other duties.

**George M. Brum** has been appointed roadmaster on the Oklahoma-Southern division of the Chicago, Rock Island & Pacific, with headquarters at Enid, Okla., succeeding **E. W. Gulley,** who has retired under the pension rules of the company.

**R. H. Carter,** supervisor on the Bloomington, Pontiac and Tracy districts of the Illinois Central, with headquarters at Kankakee, Ill., has been transferred to the Chicago terminal, succeeding **A. S. Latham,** who has been transferred to Kankakee to succeed Mr. Carter.

**A. E. Kemp,** whose promotion to roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Madison, S. D., was noted in the September issue, was born on July 29, 1897, at Ayrshire, Iowa. Mr. Kemp entered railway service in 1910 as a section laborer on the Milwaukee. He was promoted to extra gang timekeeper in 1912, and in 1918 was further promoted to section foreman, serving in that capacity and as extra gang foreman until 1920, when he became a roadmaster's clerk. In 1921 he resumed his duties as section foreman and extra gang foreman and continued in these positions until the time of his recent promotion to roadmaster.

**Ralph R. Lowe,** whose promotion to roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Ottumwa, Iowa, was noted in the September issue, was born on June 19, 1881, at Dale, Wis. Mr. Lowe entered railway service in 1904 as a rodman on the location of the Wisconsin & Northern (now a part of the Minneapolis, St. Paul & Sault Ste. Marie), and was promoted successively to levelman and resident engineer on construction. He entered the employ of the Milwaukee on April 1, 1912, as an instrumentman on the Iowa division, where he remained until December, 1914, when he left the service on account of a reduction of force. He returned to the W. & N. as a resident engineer in December, 1914, where he remained until September, 1917, when he returned to the Milwaukee as an instrumentman, which position he was holding at the time of his recent promotion to roadmaster.

**J. H. Ault,** assistant supervisor on the Columbus division of the Pennsylvania, has been promoted to supervisor on the Toledo division, with headquarters at Detroit, Mich. **B. Colange,** track foreman on the Columbus division, has been promoted to supervisor on the Chicago Terminal division, with headquarters at Chicago. **N. J. Allinger,** assistant on engineer corps on the Ft. Wayne division, has been promoted to assistant supervisor on the Chicago Terminal division. **W. W. Clarke,** assistant supervisor on the Indianapolis division, has been promoted to acting supervisor on the Toledo division, with headquarters at Marion, Ohio. **E. R. Burchette,** assistant supervisor on the St. Louis division at Greenville, Ill., has been promoted to supervisor, with headquarters at Logansport, Ind., succeeding **H. W. Thompson,** who has been transferred to the Toledo division, with headquarters at Toledo, Ohio, where he succeeds **Robert McClaren,** who has resigned.

## Bridge and Building

**M. J. Wylie** has been appointed bridge and building master on the Canadian National, with headquarters at Saskatoon, Sask., succeeding **J. A. Crawford,** who has been transferred to Kamloops, B. C., to replace **C. F. O'Connor,** whose promotion to superintendent of construction, with headquarters at Edmonton, Alta., is noted elsewhere in this issue.

## Purchasing and Stores

**B. W. Roberts,** assistant general purchasing agent of the Canadian Pacific, with headquarters at Montreal, Que., has been promoted to general purchasing agent, with headquarters in the same city, succeeding **E. N. Bender,** who has retired after 47 years' service with that company, and **T. M. McKeown,** purchasing agent at Vancouver, B. C., has been promoted to assistant general purchasing agent to succeed Mr. Roberts. **R. J. White** has been appointed purchasing agent at Calgary, Alta., to succeed **E. C. P. Cushing,** who has been transferred to Vancouver to succeed Mr. McKeown. **Frank Cooper, J. Arnott** and **W. T. Plumb** have been appointed assistant purchasing agents, with headquarters at Vancouver, Calgary and Winnipeg, Man., respectively.

## Obituary

**J. T. Curran,** roadmaster on the Gulf, Colorado & Santa Fe., with headquarters at Galveston, Tex., died in that city on October 25, at the age of 65 years.

**A. W. Peterson,** roadmaster on the Parsons-Joplin division of the Missouri-Kansas-Texas, with headquarters at Parsons, Kan., was killed on September 3 as the result of a motor car derailment near Columbus, Kan.

**Edmund J. Mulvihill,** formerly roadmaster on the Southern Pacific, died at his home in Los Angeles, Cal., as the result of a sudden heart attack. Mr. Mulvihill, who was 69 years old at the time of his death, was roadmaster at Beaumont, Cal., from 1888 to 1895, at which time he was transferred to Colton, Cal., where he served until 1906.

**Charles S. Henning,** office engineer for the assistant general manager of the Southern Pacific at El Paso, Tex., and at one time a general roadmaster on the Atchison, Topeka & Santa Fe, died on August 7. Mr. Henning was born on June 2, 1856, at Plano, Ill., and graduated from the University of Michigan in 1879. After leaving college he entered railway service on surveys for the Atlantic & Pacific (now a part of the Santa Fe) and later was engaged in surveys and construction on the Santa Fe. After the competion of the A. & P., he was promoted to general roadmaster of that road, and later was with the engineering department of the Santa Fe. After serving as a locating engineer on the Chicago, Rock Island & Pacific, he entered the employ of the El Paso & Southwestern (now a part of the Southern Pacific) in the same capacity, remaining with that road and its successor until the time of his death, with the exception of about a year in 1913 and 1914, when he was chief engineer of the Mexico Northwestern.

**George Henry Hicks,** chief engineer of the Northwestern Pacific, with headquarters at San Francisco, Cal., died at his home in Berkeley, Cal., on October 21, after 17 years service in the engineering department of that company. Mr. Hicks was born at Savanna, Ill., on May 11, 1884, and entered railway service in April, 1902, in the engineering department of the Chicago, Milwaukee & St. Paul, being assigned to the Pacific Coast extension. A year later he became connected with the engineering department of the Western Pacific where he served with preliminary and location survey parties on the line between San Francisco, Cal., and Salt Lake City, Utah, and as a resident engineer in charge of construction in the Feather River canyon and on the Altamont grade. From 1909 to 1911, Mr. Hicks was with the engineering department of the Southern Pacific on valuation work and he was then transferred to the engineering department of the Northwestern Pacific. With the latter railroad he served successively as assistant engineer, assistant valuation engineer and principal assistant engineer until 1921 when he was appointed acting chief engineer. In the following year he was promoted to valuation and property engineer. In January, 1924, Mr. Hicks was further promoted to chief engineer, which position he was holding at the time of his death on October 21.

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**The Southern Pacific of Mexico** was so badly damaged by heavy rains and high winds on September 20 and 21 that through train service was suspended until September 27.

STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., for October 1, 1928.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Henry Lee, who, having been duly sworn according to law, deposes and says that he is the Treasurer of the Simmons-Boardman Publishing Co., publisher of *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 105 W. Adams St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 105 W. Adams St., Chicago, Ill.

Business Manager, F. C. Koch, 30 Church St., New York, N. Y.

2. That the owner is:

Simmons-Boardman Publishing Co., New York, N. Y. Owners of 1 per cent or more of the total amount of capital stock are: Edward A. Simmons, New York, N. Y.; Henry Lee, New York, N. Y.; Cecil R. Mills, New York, N. Y.; George Slate, New York, N. Y.; Roy V. Wright, New York, N. Y.; Herbert L. Aldrich, New York, N. Y.; Samuel O. Dunn, Chicago, Ill.; Carrie E. Dunn, Chicago, Ill.; Lucius B. Sherman, Chicago, Ill.; Elmer T. Howson, Chicago, Ill.; Frederick H. Thompson, Cleveland, Ohio.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

HENRY LEE,
Treasurer.

Sworn to and subscribed before me this 27th day of September, 1928.

[SEAL] H. D. NELSON,

(My commission expires March 30, 1929.)

# Buyers' Guide

## CLASSIFIED INDEX TO ADVERTISERS

**Acetylene Dissolved**
Oxweld Railroad Service Company

**Air Compressors**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Air Generator Sets**
Buda Co.

**Air Hoists**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Air Lift Pumping Machinery**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Aluminum Paint**
Aluminum Company of America

**Anchors, Rail**
See Rail Anchors

**Anti-Creepers, Rail**
Bethlehem Steel Co.
Lundie Engineering Co.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

**Asphalt**
Kentucky Rock Asphalt Co.
Lehon Co.
Ohio Valley Rock Asphalt Co.

**Ballast Cleaners**
Industrial Brownhoist Corp.
Railway Maintenance Corp.

**Ballast Spreaders**
Jordan Co., O. F.

**Bank Builders**
Jordan Co., O. F.

**Bank Slopers**
Jordan Co., O. F.

**Ballast Trimmers**
Jordan Co., O. F.

**Bags, Cement**
Bates Valve Bag Co.

**Band Saws**
American Saw Mill Machinery Co.

**Bars**
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

**Bearings, Axle**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

**Bearings, Roller**
Timken Roller Bearing Co.

**Bearings, Tapered Roller; Thrust and Journal Box**
Timken Roller Bearing Co.

**Benders, Rail**
See Rail Benders

**Blowers, Turbo**
Ingersoll-Rand Co.

**Bolts**
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog & Switch Co.

**Bonding Outfits, Rail**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Braces, Track**
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

**Buckets**
Industrial Brownhoist Corp.
Owen Bucket Co.

**Buckets, Clam Shell**
Industrial Brownhoist Corp.
Owen Bucket Co.

**Building Beams, Concrete**
Federal Cement Tile Co.
Massey Concrete Prod. Corp.

**Building Papers**
Lehon Co.

**Bumping Posts**
Buda Co.
Louisville Frog & Switch Co.
Mechanical Mfg. Co.

**Calcium Carbide**
Oxweld Railroad Service Co.

**Car Replacers**
American Chain Co., Inc.
Louisville Frog & Switch Co.

**Cars, Ballast**
See Ballast Cars

**Cars, Dump**
See Dump Cars

**Cars, Hand**
Buda Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.

**Cars, Industrial**
Koppel Industrial Car & Equip. Co.
Magor Car Corp.

**Cars, Inspection**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

**Cars, Motor**
Buda Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Woolery Machine Co.

**Cars, Section**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

**Car, Spreader**
Jordan Co., O. F.

**Cars, Velocipede**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.

**Castings**
Bethlehem Steel Co.
Louisville Frog & Switch Co.
Timken Roller Bearing Co.
Wharton, Jr. & Co., Inc., Wm.

**Catchbasins**
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

**Cattle Guards**
Kalamazoo Railway Supply Co.

**Cattle Passes**
Massey Concrete Products Corp.

**Cement, Portland**
Ash Grove Lime & Portland Cement Co.
Portland Cement Assn.

**Cement Roofing Tile**
Federal Cement Tile Co.

**Chemical Weed Killer**
Chipman Chemical Engineering Co., Inc.

**Clamshell Buckets**
See Buckets, Clamshell

**Clips, Adjustable**
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

**Coal Handling Machinery**
Industrial Brownhoist Corp.
Northwest Engineering Co.

**Compressors**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Compromise Joints**
See Joints, Compromise

**Concrete Roofing Tile**
Federal Cement Tile Co.

**Concrete Units, Miscellaneous**
Federal Cement Tile Co.
Massey Concrete Prod. Corp.

**Condensers**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Corrosion Preventive**
Dearborn Chemical Co.

**Corrugated Iron**
Armco Culvert Mfrs. Ass

**Cranes, Barge, Electric Erecting, Gantry, Locomotive, Pillar, Transfer, Tunnel, Wharf and Wrecking**
American Hoist & Derrick Co.
Buckeye Traction Ditcher Co.
Industrial Brownhoist Corp.
Northwest Engineering Co.

**Creosoted Timber**
See Timber, Creosoted

**Cribbing, Concrete**
Federal Cement Tile Co.
Massey Concrete Products Corp.

**Crossing Gates**
Buda Co.
Foote Bros. Gear & Machine Co.
Kalamazoo Railway Supply Co.

**Crossings, Highway**
Kentucky Rock Asphalt Co.
Ohio Valley Rock Asphalt Co.

**Crossings, Rail**
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Culvert Pipe**
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.
Massey Concrete Products Corp.
U. S. Cast Iron Pipe & Fdry. Co.

**Culverts, Corrugated Metal**
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

**Curbing**
Massey Concrete Products Corp.

**Cypress, Red**
Southern Cypress Mfrs. Ass'n.

**Derails**
Q. & C. Co.
Wharton Jr. & Co., Wm.

**Derailing Switches**
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

**Diesel Engines**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Diesel Electric Power Plants**
Ingersoll-Rand Co.

**Dieing Machines**
Fairmont Railway Motors, Inc.

**Disinfectants**
Chipman Chemical Engineering Co., Inc.

**Ditchers**
American Hoist & Derrick Co.
Buckeye Traction Ditcher Co.
Jordan Co., O. F.
Northwest Engineering Co.

**Doors**
Richards-Wilcox Mfg. Co.

**Draglines**
Northwest Engineering Co.

**Drains, Perforated**
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

**Drills, Earth**
Buda Co.

**Drills, Pneumatic**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Drills, Rock**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works

**Drill Steel, Rock**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Drills, Track**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.
Louisville Frog & Switch Co.

**Dump Cars**
Jordan Co., O. F.
Koppel Industrial Car & Equip. Co.
Magor Car Corp.

**Electric Cranes (Locomotive, Pillar, Transfer & Wrecking)**
See Cranes

**Electric Power Units**
Electric Tamper & Equipment Co.
Syntron Co.

**Electric Snow Melters**
Lundie Engineering Corp.
Q. & C. Co.

**Engines, Gasoline**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

**Engines, Motor Car**
Buda Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

**Engines, Oil**
Buda Co.
Chicago Pneumatic Tool Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.

**Excavators**
American Hoist & Derrick Co.
Northwest Engineering Co.

**Fences**
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association
Q. & C. Co.

**Fence, Fabric**
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association

**Fence Posts**
Anchor Post Fence Co.
Long-Bell Lumber Co.
Massey Concrete Products Corp
Page Fence Association
Q. & C. Co.

**Fibre Angle Pieces, Bushings, Etc.**
Q. & C. Co.

**Fibre Insulation**
Q. & C. Co.

**Flangers, Snow**
Q. & C. Co.

**Flangeway Guard**
Bethlehem Steel Co.

**Floor Coverings**
Lehon Co.

**Forgings**
Bethlehem Steel Co.

**Frogs**
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Inc., Wm.

**Gages, Measuring**
Lufkin Rule Co.

**Gages, Pressure Gas**
Oxweld Railroad Service Co.

**Gas, Acetylene**
Oxweld Railroad Service Co.

**Gates, Drainage**
Armco Culvert Mfrs. Assn.
Central Alloy Steel Corp.

**Grading Machinery**
American Hoist & Derrick Co.

**Graphite**
Dixon Crucible Co., Jos.
U. S. Graphite Co.

**Graphite Paint. See Paint, Graphite**

**Grease, Track**
U. S. Graphite Co.

**Grinders, Portable**
Buda Co.
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Guard Rails**
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Carnegie Steel Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp
Wharton Jr. & Co., Wm.

**Guard Rail Clamps**
American Chain Co., Inc.
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Hammers, Chipping, Sealing and Calking**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Hammer Drills**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Hammers, Forge**
Sullivan Machinery Co.

**Hammers, Riveting**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Hand Car Bearings**
Timken Roller Bearing Co.

**Head Drains, Perforated**
Central Alloy Steel Corp.

**Heel Blocks**
Bethlehem Steel Co.

**Highway Crossings**
See Crossings, Highway

**Hoisting Machinery**
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

**Hoists, Air Motor**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Hose**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**House Lining**
Lehon Co.

**Ice Cutters**
Jordan Co., O. F.

**Insection Cars**
See Cars, Inspection

**Inspection, Engineering**
Hunt Co., Robert W.

**Insulated Rail Joints**
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

**Insulating Material**
Lehon Co.

**Jacks, Bridge**
Buda Co.
Kalamazoo Railway Supply Co.

**Jacks, Track**
Buda Co.
Kalamazoo Railway Supply Co.
Verona Tool Works

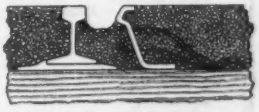
**Joints, Compromise**
American Chain Co., Inc.
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

**Joint Fastenings**
Illinois Steel Co.

**Joints, Rail**
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

**Joints, Step**
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.

# Better Crossings!



Cross-section of an installation of a Flangeway Guard at a grade crossing. Note there is no contact between the Flangeway Guard and the Rail.

# Bethlehem Braced Flangeway Guard

The Bethlehem Braced Flangeway Guard is designed to prevent damage to the pavement from the movement and vibration of the rail. This guard is reinforced by detachable steel braces which are locked to the web of the guard through rectangular holes and spiked to the ties.

This guard was formerly known as the Lebanon Flangeway Guard made by the Lebanon Steel Foundry. Bethlehem Steel Company recently acquired the patents and it is being manufactured with improvements in design and construction.

Bethlehem Braced Flangeway Guards are rolled and pressed into long straight sections and flared end sections. They are quickly and easily installed, making a smooth-riding, neat-appearing crossing with maximum protection to paving. They will pay for themselves many times over in reduced maintenance expense.

BETHLEHEM STEEL COMPANY, *General Offices:* BETHLEHEM, PA.

DISTRICT OFFICES

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo Cleveland
Detroit Cincinnati Chicago St. Louis San Francisco Los Angeles Seattle Portland Honolulu

*Bethlehem Steel Export Corporation, 25 Broadway, New York, Sole Exporter of our Commercial Products*

# BETHLEHEM

# BUYERS' GUIDE

**Junction Boxes**
Massey Concrete Products Corp.

**Knuckles, Emergency**
Q. & C. Co.

**Liners, Track**
Buda Co.
Rail Joint Co.

**Lock Washers**
Louisville Frog & Switch Co.
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works

**Locomotives, Oil Engine Electric Drives**
Ingersoll-Rand Co.

**Lubricants**
Dixon Crucible Co., Jos.

**Lumber**
National Lumber Mfrs. Ass'n
Southern Cypress Mfrs. Ass'n.

**Manganese Track Work**
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Manholes**
Massey Concrete Products Corp.

**Markers**
Massey Concrete Products Corp.

**Mile Posts**
Massey Concrete Products Corp.

**Motor Bearings**
Timken Roller Bearing Co.

**Motor Cars**
See Cars, Motor

**Mowing Machines**
Fairmont Railway Motors, Inc.

**Non-Derailer**
Ramapo Ajax Corp.

**Nut Locks**
Louisville Frog & Switch Co.
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

**Nuts**
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog & Switch Co.

**Oil Engines**
See Engines, Oil

**Out Houses**
Massey Concrete Products Corp.

**Oxygen**
Oxweld Railroad Service Co.

**Oxy-Acetylene Welding Equipment**
Oxweld Railroad Service Co.

**Paint**
Aluminum Co. of America
Dixon Crucible Co., Jos.
Semet-Solvay Co.
U. S. Graphite Co.

**Paint, Graphite**
Dixon Crucible Co.
Semet-Solvay Co.
U. S. Graphite Co.

**Paint, Metal Protective**
Aluminum Co. of America
Dixon Crucible Co., Jos.
Semet-Solvay Co.
U. S. Graphite Co.

**Pavement Breakers**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

**Pile Drivers**
American Hoist & Derrick Co.
Ingersoll-Rand Co.
Industrial Brownhoist Corp.

**Piling**
Carnegie Steel Co.
Jennison-Wright Co.
Long-Bell Lumber Co.
Massey Concrete Products Corp.
Prettyman & Sons, J. F.

**Pipe, Cast Iron**
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

**Pipe Carriers**
Massey Concrete Products Corp.

**Pipe, Concrete**
Massey Concrete Products Corp.

**Pipe, Corrugated**
Armco Culvert Mfrs. Assn.

**Pipe Joint Compound**
Dixon Crucible Co., Jos.

**Pipe, Sewer**
Armco Culvert Mfrs. Assn.
Central Foundry Co.
Massey Concrete Products Corp.

**Plates, Miscellaneous**
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

**Platforms, Station**
Kentucky Rock Asphalt Co.
Ohio Valley Rock Asphalt Co.

**Poles**
Jennison-Wright Co.
Long-Bell Lumber Co.
Massey Concrete Products Corp.
Prettyman & Sons, J. F.

**Posts, Fence**
See Fence Posts

**Posts, Bumping**
See Bumping Posts

**Post Hole Diggers**
Buda Co.

**Power Plants, Portable**
Electric Tamper & Equipment Co.
Syntron Co.

**Preservation, Timber**
Curtin-Howe Corp.
Jennison-Wright Co.
Long-Bell Lumber Co.
Prettyman & Sons, J. F.

**Products, Gas**
Oxweld Railroad Service Co.

**Pumps, Air Pressure & Vacuum, Centrifugal, Deep Well, Piston, Plunger, Rotary, Slump**
American Well Works
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Layne & Bowler, Inc.
Sullivan Machinery Co.
United Iron Works, Inc.

**Push Cars**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.

**Push Car Bearings**
Timken Roller Bearing Co.

**Rail Anchors**
Bethlehem Steel Co.
Louisville Frog & Switch Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

**Rail Anti-Creepers**
See Anti-Creepers, Rail

**Rail Benders**
American Chain Co., Inc.
Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Verona Tool Works

**Rail Bonds**
Verona Tool Works

**Rail Braces**
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

**Rail Expanders**
Ramapo Ajax Corp.

**Rail Joints**
See Joints, Rail

**Rail Layers**
Buckeye Traction Ditcher Co.

**Rail Saws, Portable**
Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.
Q. & C. Co.

**Rail Springs**
Verona Tool Works

**Rails, Girder**
Bethlehem Steel Co.

**Rails, Tee**
Bethlehem Steel Co.
Carnegie Steel Co.
Louisville Frog & Switch Co.

**Regulators, Oxy-Acetylene**
Oxweld Railroad Service Co.

**Replacers, Car & Locomotive**
American Chain Co., Inc.
Buda Co.
Q. & C. Co.

**Retaining Walls, Precast**
Federal Cement Tile Co.
Massey Concrete Product Corp.

**Rivets**
Bethlehem Steel Co.
Louisville Frog & Switch Co.

**Rock Hammers**
Ingersoll-Rand Company

**Rods, Welding**
Oxweld Railroad Service Co.

**Roof Slabs**
Federal Cement Tile Co.
Massey Concrete Products Corp.

**Roofing, Cement & Concrete Tile**
Federal Cement Tile Co.

**Roofing Composition**
Lehon Co.

**Rules**
Lufkin Rule Co.

**Rust Preventive**
Dearborn Chemical Co.

**Safety Flags**
Louisville Frog & Switch Co.

**Saw Rigs**
American Saw Mill Machinery Co.

**Saws, Electric**
Reed-Prentice Corp.

**Saws, High Speed Friction**
American Saw Mill Machinery Co.

**Saw Mills**
American Saw Mill Machinery Co.

**Scales, Tape**
Lufkin Rule Co.

**Screw Spikes**
Illinois Steel Company

**Screw Spike Drivers**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Section Cars**
See Cars, Section

**Sharpeners, Rock Drill Steel**
Ingersoll-Rand Co.

**Sheathing Paper**
Lehon Co.

**Sheet Iron**
Armco Culvert Mfrs. Assn.

**Shingles, Composition**
Lehon Co.

**Shovels**
Verona Tool Works
Woodings Forge & Tool Co.

**Shovels, Steam**
American Hoist & Derrick Co.
Northwest Engineering Co.

**Signal Foundations, Concrete**
Massey Concrete Products Corp.

**Skid Excavators & Dredges**
Northwest Engineering Co.

**Skid Shoes**
Q. & C. Co.

**Slabs, Concrete**
Massey Concrete Products Corp.

**Smoke Stacks**
Massey Concrete Products Corp.

**Snow Melting Device**
Lundie Engineering Corp.
Q. & C. Co.

**Snow Plows**
Jordan Co., O. F.
Q. & C. Co.

**Spikes**
Bethlehem Steel Co.
Illinois Steel Company

**Spike Pullers**
Louisville Frog & Switch Co.

**Spreader Cars**
See Cars, Spreader

**Spreaders, Ballast**
See Ballast Spreaders

**Stands, Switch & Target**
Bethlehem Steel Co.
Louisville Frog & Switch Co.
Q. & C. Co.
Ramapo Ajax Corp.

**Steel, Alloy**
Central Alloy Steel Corp.
Illinois Steel Company

**Steel Cross Ties**
Carnegie Steel Co.

**Steel, Electric Furnace**
Timken Roller Bearing Co.

**Steel, Open Hearth**
Timken Roller Bearing Co.

**Steel Plates and Shapes**
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

**Steel, Special Analysis**
Timken Roller Bearing Co.

**Step Joints**
See Joints, Step.

**Structural Steel**
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

**Switch Guard**
Louisville Frog & Switch Co.
Ramapo Ajax Corp.

**Switches**
Bethlehem Steel Co.
Buda Co.
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Switchmen's Houses**
Massey Concrete Products Corp.

**Switchstands & Fixtures**
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

**Tampers, Tie**
See Tie Tampers

**Tapes, Measuring**
Lufkin Rule Co.

**Tee Rails**
See Rails, Tee.

**Telegraph Poles**
See Poles

**Testing of Materials**
Hunt Co., Robert W.

**Thawing Outfits**
Lundie Engineering Corp.
Q. & C. Co.

**Ties**
Jennison-Wright Co.
Long-Bell Lumber Co.
Prettyman & Sons, J. F.

**Tie Plate Clamps**
Q. & C. Co.

**Tie Plates**
Bethlehem Steel Co.
Illinois Steel Co.
Louisville Frog & Switch Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

**Tie Rods**
Bethlehem Steel Co.
Louisville Frog & Switch Co.

**Tie Scorer**
Woolery Machine Co.

**Tie Tampers**
Chicago Pneumatic Tool Co.
Electric Tamper & Equipment Co.
Ingersoll-Rand Co.
Syntron Co.

**Tile, Roofing**
Federal Cement Tile Co.

**Timber**
National Lumber Mfrs. Ass'n
Southern Cypress Mfrs. Ass'n.

**Timber, Creosoted**
Jennison-Wright Co.
Long-Bell Lumber Co.
Prettyman & Sons, J. F.

**Tools, Oxy-Acetylene Cutting & Welding**
Oxweld Railroad Service Co.

**Tools, Pneumatic**
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

**Tools, Track**
Buda Co.
Verona Tool Works
Woodings Forge & Tool Co.

**Tongue Switches**
Bethlehem Steel Co.
Buda Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

**Torches, Oxy-Acetylene Cutting & Welding**
Oxweld Railroad Service Co.

**Track Braces**
See Braces, Track

**Track Cranes**
Buckeye Traction Ditcher Co.

**Track Drills**
See Drills, Track

**Track Gages**
Buda Co.
Kalamazoo Railway Supply Co.
Louisville Frog & Switch Co.

**Track Insulation**
Q. & C. Co.

**Track Jacks**
See Jacks, Track

**Track Levels**
Kalamazoo Railway Supply Co.

**Track Liners**
See Liners, Track

**Track, Special Work**
Louisville Frog & Switch Co.
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

**Track Tools**
See Tools, Track

**Trestle Slabs**
Massey Concrete Products Corp.

**Trucks, Hand, Steel**
Anchor Post Fence Co.

**Tubing, Seamless Steel**
Timken Roller Bearing Co.

**Ventilators**
Q. & C. Co.

**Water Supply Contractors**
Layne & Bowler, Inc.

**Water Treating Plants**
Dearborn Chemical Co.

**Waterproofing Fabrics**
Lehon Co.

**Weed Burner**
Fairmont Railway Motors, Inc.
Woolery Machine Co.

**Weed Killer**
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

**Welding & Cutting Equipment**
Electric Railweld Service Corp.
Oxweld Railroad Service Co.

**Welding, Electric**
Electric Railweld Service Corp.

**Welding, Oxy-Acetylene**
Oxweld Railroad Service Co.

**Well Systems**
Layne & Bowler, Inc.

**Wheels, Hand & Motor Car**
Buda Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

**Wheels, Wrought Steel**
Carnegie Steel Co.

**Wire Fencing**
American Steel & Wire Co.
Anchor Post Fence Co.
Cyclone Fence Co.
Page Fence Association

**Wood Preservation**
See Preservation, Timber

**Wood Working Machinery**
American Saw Mill Machinery Co.

# ALPHABETICAL INDEX TO ADVERTISERS

IMPROVED HIPOWER
THE STANDARD

Improved Hipower is usually specified. Sometimes as a matter of course because it is generally accepted as the standard by most roads.

Sometimes because one or two of its points of superiority meet a special condition.

We want it to remain the standard of railroad spring washers always, but we also want its many specific advantages to be well known everywhere.

That is why in most of our advertisements this year we take up the many points of Improved Hipower superiority one by one. Whenever it is specified, it should be with the full knowledge that it is, for several sound reasons, the best that can be had.

*There are many points of Improved Hipower superiority. This is point of superiority No. 8.*

## Controlled from Billet to Finished Product

The uniformity of our spring washers is due mainly to the uninterrupted control and inspection of every process of manufacture from receipt of the raw billet on.

Our own rolling mill inspects before accepting the billets that are made strictly in accordance with our own specifications. From that point on our own organization controls every step from rolling to packing for shipment. All makers of metal products realize how ideal such a situation is. We are able to safely guarantee and assume full responsibility for our entire output.

The most exacting tests check each step. The railroads have learned that they can buy National products with a feeling of implicit confidence in our superior workmanship and in the uniformity of our output.

There are many other points of superiority. Our advertisements will announce them.

THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

# IMPROVED HIPOWER

**Commercially Non-flattenable - - Permanently Rust-Proof**